

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation   |
|------------------------|---|
| 1PPS                   | One Pulse Per Second  |
| 40m                    | R&D Test Facility at LIGO Caltech   |
| 40m Lab                | R&D Test Facility at LIGO Caltech   |
| AA                     | Anti-Aliasing   |
| AAAS                   | American Association for the Advancement of Science   |
| AAPT                   | American Association of Physics Teachers  |
| AC                     | Alternating Current   |
| ACB                    | Arm Cavity Baffle (element of aLIGO AOS)  |
| ACIGA                  | Australian Consortium for Interferometric Gravitational Wave Astronomy  |
| ACR                    | Advanced LIGO Change Request  |
| ACWP                   | Actual Cost of Work Performed   |
| ADC                    | Analog-to-Digital Converter   |
| ADCU                   | Analog Data Collection Unit; Analog to Digital Converter Unit (A computer that takes an analog signal and assigns a digital value for computations) |
| ADE                    | Advanced Detector Era   |
| AdL                    | Advanced LIGO (not used after 20091104; use aLIGO instead)  |
| AdLIGO                 | Advanced LIGO (not used after 20091104; use aLIGO instead)  |
| AdvLIGO                | Advanced LIGO (not used after 20091104; use aLIGO instead)  |
| AEI                    | Albert Einstein - Max Planck Gravitational Wave Institute, partner with LZH   |
| AERA                   | American Educational Research Association   |
| AI                     | Anti-Imaging  |
| AIA                    | American Institute of Architects  |
| AIC                    | Advanced Interferometer Configurations (USF)  |
| AISES                  | American Indian Science and Engineering Society   |
| AL                     | Advanced LIGO (not used after 20091104; use aLIGO instead+B454)   |
| ALH                    | Alarm Handler (EPICS)   |
| aLIGO                  | Advanced LIGO (used after 20091104)   |
| ALS                    | Armlength Stabilization System (aLIGO ISC)  |
| ALUK                   | Advanced LIGO UK consortium   |
| AM                     | Amplitude Modulation  |
| AMD                    | Acoustic Mode Damper  |
| AMO                    | Atomic, Molecular & Optical   |
| AMU                    | Atomic Mass Unit  |
| ANL                    | Argonne National Laboratory?  |
| ANTARES                | Astronomy with a Neutrino Telescope and Abyss environmental RESearch  |
| ANU                    | Australian National University  |
| AOC                    | Adaptive Optics Compensation  |
| AOM                    | Acousto-Optic Modulation  |
| AOS                    | Auxiliary Optics System (subsystem in aLIGO)  |
| API                    | Application Programming Interface   |
| APS                    | American Physical Society; Absentmindedness Prevention System   |
| AR                     | Anti-Reflection Coating; Anti-Reflective  |
| AS                     | Anti-Symmetric  |

LIGO Abbreviations And Acronyms

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|------------------------|---|
| ASC                    | Alignment Sensing and Control (detector subsystem) - Generally speaking, this controls mirror positions (6 degrees of freedom); Angular Sensing and Control |
| ASI                    | Anti-Symmetric Input  |
| ASIC                   | Application Specific Integrated Circuit   |
| ASPD                   | Anti-Symmetric Photo Diode (4 of them on ISCT4)   |
| ASTC                   | Association of Science - Technology Centers   |
| ATM                    | Asynchronous Transfer Mode (communications protocol)  |
| ATR                    | Acceptance Test Report  |
| AuxMVC                 | Multivariate Classifiers for Auxiliary Channels   |
| AWG                    | Arbitrary Waveform Generator  |
| AXP                    | Anomalous X-ray pulsar  |
| AY                     | Actual Year   |
| BAC                    | Budget at Completion  |
| BAE                    | Biological and Agricultural Engineering   |
| Baudline               | A plotting tool   |
| BBH                    | Binary Black Hole pair  |
| BCS                    | Beam Centering Servo - Centers beam on beam splitter (visual on SPIRICON)   |
| BCV                    | Bilinear Coupling Veto  |
| BCWP                   | Budgeted Cost of Work Performed   |
| BCWS                   | Budgeted Cost of Work Scheduled   |
| BH                     | Black Hole  |
| BH-BH                  | Black Hole - Black Hole (Binary Black Hole pair)  |
| BJT                    | Bipolar Junction Transistor   |
| BNC                    | Bayonet Nut Connector   |
| BNS                    | Binary Neutron Star pair  |
| BOSEM                  | Birmingham University version of the OSEM, optical sensor - electromagnetic motor unit  |
| BPCU                   | Beam Pointing Control Unit  |
| BRDF                   | Bidirectional Reflection Distribution Function  |
| BRS                    | Beam Rotation Sensor  |
| BRT                    | Beam Reducing Telescope (AOS TMS element)   |
| BS                     | Beam Splitter; Obvious academic alternative reluctantly removed   |
| BSC                    | Basic Symmetric Chamber; Beam Splitter Chamber (large vacuum chamber)   |
| BSC1                   | LLO - houses ITMY   |
| BSC2                   | LLO - houses Beam splitter  |
| BSC3                   | LLO - houses ITMX   |
| BSC4                   | LLO - houses ETMX   |
| BSC5                   | LLO - houses ETMY   |
| BSDF                   | Bidirectional Scatter Distribution Function   |
| BSM                    | Beam Spot Motion  |
| BT                     | Beam Tube   |
| BTE                    | Beam Tube Enclosure   |
| CA                     | Clear Aperture; Channel Access (EPICS Control & Monitoring system network protocol)   |
| CACR                   | Center for Advanced Computer Research (Caltech)   |
| CAD                    | Computer Aided Design   |

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|------------------------|--|
| CaJAGWR                | Caltech-JPL Association for Gravitational Wave Research  |
| Caltech                | California Institute of Technology   |
| CARM                   | Common Arm Length - Sum of the arm length (to establish laser frequency) = $(L_x + L_y)$   |
| CB&I                   | Chicago Bridge & Iron  |
| CBC                    | Compact Binary Coalescence; Columbia Basin College   |
| CC                     | Civil Construction   |
| CCB                    | Change Control Board; Configuration Control Board  |
| CCD                    | Charge Coupled Device  |
| CCSNs/CCSNe            | Core Collapse Super Novae  |
| CD                     | Conceptual Design  |
| CDR                    | Conceptual Design Review   |
| CDRL                   | Contract Data Requirements List  |
| CDS                    | Control and Data System (detector subsystem); Cognitive Development Society  |
| CIT                    | California Institute of Technology   |
| CMB                    | Cosmic Microwave Background  |
| CMRR                   | Common Mode Rejection Ratio  |
| CMS                    | Control and Monitoring System (a part of CDS)  |
| CO                     | Carbon Monoxide  |
| CO <sub>2</sub>        | Carbon Dioxide; also CO <sub>2</sub> Laser, used in the Auxiliary Optics Thermal Compensation subsystem  |
| COC                    | Core Optics Components (detector subsystem)  |
| CompComm               | Computing Administration Committee   |
| Conlog                 | A method of monitoring and storing EPICS channel values  |
| COS                    | Core Optics Support (detector subsystem)   |
| COTS                   | Commercial Off-The-Shelf (procured items)  |
| CP                     | Cryogenics Pump; Compensation Plate ( part of TCS); Chiller Pad (part of FAC)  |
| CPS                    | Capacitive Position Sensor (element of aLIGO seismic isolation system); or Cycles Per Second   |
| CPU                    | Central Processing Unit  |
| CR                     | Control Room   |
| CRC                    | Cyclic Redundancy Check  |
| CSC                    | Computer Security Committee  |
| CSIRO                  | Commonwealth Scientific and Industrial Research Organization (Australia)   |
| CSSR                   | Cost Schedule Status Report  |
| CTNI                   | Cryogenic Thermal Noise Interferometer   |
| CVS                    | Concurrent Versions System - A method for controlling versions   |
| CW                     | Continuous Wave  |
| cWB                    | Coherent wave burst  |
| DAC                    | Digital-to-Analog Converter  |
| DAQ                    | Data Acquisition ( Diagnostics and Controls (aLIGO Subsystem name))  |
| DAQS                   | Data Acquisition System  |
| DARM                   | Differential Arm {Length, Signal} - Difference between the x and y arm lengths; This is the main interferometer output signal for GW detection = $(L_x - L_y)$ |
| DASWG                  | Data Analysis Software Working Group   |
| Dataviewer             | A data visualization tool  |

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|------------------------|--|
| dB                     | Decibel  |
| DBB                    | Diagnostic Bread Board   |
| DC                     | Direct Current (steady state)  |
| DC readout             | Direct Current Readout (of the gravitational wave)                       |
| DCC                    | Document Control Center  |
| DCMON                  | DC Monitor (Voltage or Current Monitor)                                  |
| DPCD                   | DC Photodiode  |
| DCS                    | Data and Computing Systems (aLIGO subsystem name)                        |
| DCU                    | Data Collection Unit   |
| Deg                    | Degree, Degrees  |
| DET                    | Detector system  |
| DetChar                | Detector Characterization  |
| DFT                    | Discrete Fourier Transform (as opposed to Fast Fourier Transforms (FFT)) |
| DI                     | Digital Interferometry, system to allow pre-lock positioning of mirrors  |
| DIA                    | Data Information Area (of reflected memory)                              |
| DIN                    | Deutsches Institut fur Normung (German Standards Organization)           |
| DMA                    | Direct Memory Access   |
| DMRO                   | Differential Mode Read-Out   |
| DMT                    | Diagnostic Monitoring Tool; Data Monitoring Tool                         |
| DOF                    | Degree Of Freedom  |
| DoS                    | Denial of service cyber attack   |
| DRD                    | Design Requirements Document   |
| DRFPM                  | Dual-Recycled Fabry-Perot Michelson (Interferometer)                     |
| DRMI                   | Dual Recycled Michelson Interferometer                                   |
| DRR                    | Design Requirements Review   |
| DSE                    | Detector Systems Engineering   |
| DSP                    | Digital Signal Processing  |
| DTT                    | Diagnostic Test Tool   |
| e2e; E2E               | End-To-End Modeling (interferometer simulation)                          |
| EAC                    | Estimate at Completion   |
| ECA                    | EPICS Channel Access   |
| ECD                    | Eddy Current Damping   |
| ECM                    | Eistein's Cosmic Messengers  |
| EDCU                   | EPICS Data Collection Unit   |
| EDSU                   | EPICS Data Server Unit   |
| EFT                    | Effective Field Theory   |
| EGO                    | European Gravitational Wave Observatory                                  |
| EH&S                   | Environmental Health & Safety  |
| eLIGO                  | Enhanced LIGO (updated initial LIGO, in use until 20 October 2010)       |
| EM                     | Electromagnetic  |
| EMA                    | Experimental Modal Analysis System                                       |
| EMC                    | Electro-Magnetic Compatibility   |
| EMI                    | Electro-Magnetic Interference  |

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|------------------------|---|
| En                     | Engineering Run n (for example, E4 is Engineering Run 4)                                  |
| EO                     | Electro-Optical   |
| EOM                    | Electro-Optic Modulator (optical hardware)  |
| EOS                    | Equation of State   |
| EPI                    | External Pre-Isolator   |
| EPICS                  | Experimental Physics and Industrial Control System  |
| EPO                    | Education & Public Outreach   |
| ER                     | Engineering Run   |
| ERC                    | Electronic Rule Checking (PCB Design)   |
| ESD                    | Electro Static Drive / Electro-Static Discharge   |
| ESD/ESD123             | WA State Educational School District 123  |
| ET                     | Einstein Telescope  |
| ETC                    | Estimate to Complete (estimated cost to complete work)                                    |
| ETF                    | Engineering Test Facility (Caltech Lab)   |
| ETM                    | End Test Mass (mirror) - Partially reflective mirror; second mirror in Fabry Perot Cavity |
| ETM                    | End Test Mass   |
| ETMX                   | End Test Mass - X arm   |
| ETMY                   | End Test Mass - Y arm   |
| EVO                    | Enabling Virtual Organizations  |
| EXC                    | Excitation (channel)  |
| ExtTrig                | External Triggers   |
| EZCA                   | Easy Channel Access(?) EPICS Application(?)   |
| FAC                    | Facilities (part of CC) - replaced by FMP   |
| FCMS                   | Facility Control and Monitoring System  |
| FCR                    | Facility Control Room   |
| FDR                    | Final Design Review   |
| FE                     | Front End (computer)  |
| FEA                    | Finite Element Analysis   |
| FEI                    | Facilities Engineering Items  |
| FEM                    | Finite Element Model/Method   |
| FET                    | Field-effect Transistor   |
| FFT                    | Fast Fourier Transform (as opposed to Discrete Fourier Transforms (DFT))                  |
| FI                     | Faraday Isolator (optical component)  |
| FIFO                   | First In First Out  |
| FINESSE                | Frequency Domain Interferometer Simulation Software                                       |
| FIR                    | Finite Impulse Response (filter)  |
| FIT                    | Function and Integration Test   |
| FLOPS                  | Floating Point Operations Per Second  |
| FM                     | Folding Mirror; Frequency Modulation  |
| FMEA                   | Failure Modes and Effects Analysis  |
| FMP                    | Facilities Management Plan; Facility Modifications and Preparations                       |
| FOM                    | Figure Of Merit   |
| FP                     | Fabry-Perot cavity  |

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| Abbreviation / Acronym | Meaning / Explanation   |
|------------------------|---|
| FPGA                   | Field Programmable Gate Array   |
| FR                     | Faraday Rotator (optical component)   |
| Framebuilder           | A DAQS computer dedicated to building frames  |
| FS                     | Fused Silica  |
| FSR                    | Full Scale Reference  |
| FSS                    | Frequency Stabilization Servo   |
| FTE                    | Full Time Equivalent  |
| FTIR                   | Fourier Transform Infrared, Frustrated Total Internal Reflection  |
| FY                     | Fiscal Year   |
| GASF                   | Geometrical Anti-Spring Filter  |
| GB                     | Ghost Beam  |
| GC                     | General Computing   |
| GCN                    | Gamma Ray Burst Coordination Network  |
| GDS                    | Global Diagnostics System   |
| GenComp                | General Computing   |
| GEO                    | German-English Observatory; British-German Cooperation for Gravity Wave Experiment  |
| GEO-HF                 | GEO-High Frequency  |
| GFLOPS                 | Giga (1000 Million) Floating Point Operations per Second  |
| GPL                    | Graphics Program Language   |
| GPM                    | Gallons Per Minute  |
| GPS                    | Global Positioning System   |
| GRB                    | General Relativity  |
| GRB                    | Gamma-Ray Burst   |
| GRD                    | Gaurdian - aLigo interferometer automation and control software   |
| GS13                   | Geotech, Inc. Seismometer Model GS-13   |
| gstlal                 | G-streamer LIGO Analysis Library  |
| gstreamer              | GPU data analysis tool  |
| GUI                    | Graphical User Interface  |
| Guralp, STS2, Trillium | Seismic ground motion sensors manufactured by various vendors   |
| GW                     | Gravitational Wave (not Gravity Wave, which is a water-wave phenomenon)   |
| GWADW                  | Gravitational Wave Advanced Detector Workshop   |
| GWB                    | Gravitational Wave Band (10Hz through 10 kHz for 'Advanced' detectors)  |
| GWD                    | Gravitational Wave Detector   |
| GWDAW                  | Gravitational Wave Data Analysis Workshop   |
| GWIC                   | Gravitational Wave International Committee  |
| GWINC                  | Gravitational Wave Interferometer Noise Calculator. Originally developed for LIGO, this version has been modified for Advanced Virgo. |
| H                      | Horizontal  |
| H1                     | Hanford 4K Interferometer   |
| H2                     | Hanford 2K Interferometer (to be revised to 4K by aLIGO)  |
| HAM                    | Horizontal Access (Axis) Module; general purpose optics vacuum chamber (input and output optics)                                      |
| HAM AUX                | Input Optics HAM2 3-inch optics/suspensions (SM1, PMMT1, PMMT2, SM2) also known as IM1-4  |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation   |
|------------------------|---|
| HAM1                   | LLO - holds MC1, MC3, MMT1, and MMT3  |
| HAM2                   | LLO - holds MC2, MMT2   |
| HAM3                   | LLO - holds recycling mirror  |
| HAM4                   | LLO - holds telescopes, anti-symmetric port, excess light catcher   |
| HAM5                   | LLO - currently empty   |
| HAM6                   | LLO - holds output mode cleaner   |
| HAUX                   | Input Optics HAM Auxilliary Suspensions   |
| HEASARC                | High Energy Astrophysics Science Archive Research Center  |
| HEPA                   | High-Efficiency Particulate Air filter  |
| HEPI                   | Hydraulic External Pre-Isolator, an element of the SEI that isolates chambers from seismic activity                             |
| HG                     | Hermite-Gauss (typically refers to a rectangularly symmetric basis)   |
| HHLV                   | LIGO-Virgo Network  |
| HLTS                   | HAM Large Triple Suspension   |
| HOM                    | High Order Mode   |
| HPLF                   | High Power Laser Facility   |
| HPSS                   | High Performance Storage System (IBM)   |
| HR                     | High Reflectance (mirror coating); Highly Reflective; Human Resources   |
| HSTS                   | HAM Small Triple Suspension   |
| HTM                    | Higher Transverse Modes (other than TEM00 mode)   |
| HTR                    | Heater - Heats up a block of aluminum to control the shape of a mirror in the OMC (the mirror is mounted to the aluminum block) |
| HVAC                   | Heating Ventilation and Air Conditioning  |
| HWCI                   | Hardware Configuration Item   |
| HWP                    | Half-Wave Plate (optical hardware)  |
| HWS                    | Hartmann Wavefront Sensor (part of aLIGO Thermal Compensation System)   |
| Hz                     | Hertz (cycles per second)   |
| I/O                    | Input/Output  |
| I2U2                   | Interactions in Understanding the Universe  |
| IAS                    | Initial Alignment System (part of aLIGO AOS); Institut d'Astrophysique Spatiale   |
| IBS                    | Ion Beam Sputtering   |
| IC                     | Integrated Circuit  |
| ICD                    | Interface Control Document  |
| IceCube                | South Pole Neutrino Observatory   |
| ICS                    | Inventory Control System  |
| ICWD                   | Interface Control Working Group   |
| IDC                    | Insulation Displacement Contact (Connector)   |
| IDE                    | Integrated Drive Electronics (disk standard)  |
| IFO                    | Interferometer - Device used to measure interference of light   |
| IGWD                   | Interferometric Gravitational Wave Detectors  |
| IIR                    | Infinite Impulse Response (filter)  |
| IL                     | Initial LIGO  |
| ILC                    | Iterative Learning Control  |
| iLIGO                  | Initial LIGO  |

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| Abbreviation / Acronym | Meaning / Explanation   |
|------------------------|---|
| ILMON                  | In-Loop Monitor (witness sensor for RIN on the laser light)   |
| ILSENS                 | In-Loop Sensor for PSL's ISS  |
| IM                     | Input Optics Input Mirror   |
| IMBH                   | Intermediate Mass Black Hole  |
| IMC                    | Input Mode Cleaner (iLIGO 'MC')   |
| IMR                    | inspiral, merger and ringdown   |
| IMS                    | Input Mode cleaner Suspension (Obsolete in aLIGO)   |
| Ind-IGO                | Indian Initiative in Gravitational Observations   |
| Infiniband             | Point-to-point, bi-directional, high-speed, serial link   |
| InGaAs                 | Indium-Gallium-Arsenide   |
| INJ                    | Injected Signal (Injection)   |
| INS                    | Installation (aLIGO subsystem name)   |
| INSA                   | French National Institute for Applied Science   |
| IO                     | Input Optics (detector subsystem, formerly named Input / Output Optics)   |
| IOO                    | Input / Output Optics (obsolete)  |
| IOT                    | Input Optics Table - Views mode cleaner transmission and reflection (Obsolete in aLIGO)   |
| IOT(chamber #)L        | Input Optics Table (chamber #) Left (as viewed from the PSL), for example IOT2L, views input mode cleaner transmission and reflection |
| IOT(chamber #)R        | Input Optics Table (chamber #) Right (as viewed from the PSL), for example IOT2R, views HAM2 IM4 transmission                         |
| IP                     | Ion Pump; Inverted Pendulum; Internet Protocol  |
| IPAC                   | Infrared Processing and Analysis Center   |
| IPR                    | Institute for Plasma Research (India)   |
| IPS                    | Inductive Position Sensor   |
| IR                     | Infrared  |
| ISC                    | Interferometer Sensing and Control - Sensors to monitor the function of the interferometer; Instrument Sensing and Control            |
| ISCT1                  | LLO - Views symmetric port (bright fringe) of interferometer  |
| ISCT2                  | LLO - Views ???   |
| ISCT3                  | LLO - Views Y-pickoff   |
| ISCT4                  | LLO - Views Anti-symmetric (AS) (dark fringe) of interferometer/ Views X-pickoff/ Views Beam-Splitter pick off                        |
| ISCTn                  | Interferometer Sensing and Control Table n (n corresponds to the HAM it is closest to)  |
| ISI                    | Internal Seismic Isolation, an element of the SEI   |
| ISR                    | Interrupt Service Routine   |
| ISS                    | Intensity Stabilization Servo   |
| ITM                    | Input Test Mass (mirror) - Partially reflective mirror; first mirror in Fabry-Perot Cavity  |
| ITMX                   | Input Test Mass 'X' arm   |
| ITMY                   | Input Test Mass 'Y' arm   |
| IV&V                   | Integration, Verification, and Validation   |
| IWG                    | Interface Working Group   |
| IXS                    | Information eXchange Services   |
| JFET                   | Junction Field-effect Transistor  |
| JPL                    | Jet Propulsion Laboratory   |
| KAGRA                  | Large-scale Cryogenic Gravitational wave Telescope Project (Japan)  |

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|------------------------|---|
| KB                     | KiloByte  |
| KM3NeT                 | Cubic Kilometre Neutrino Telescope  |
| kpc                    | Kiloparsec  |
| L1                     | Livingston 4km Interferometer   |
| L4C                    | Sercel Seismometer Model L4C  |
| LA                     | Louisiana   |
| LAAAP                  | LIGO Astronomy and Astrophysics Advisory Panel  |
| LAI                    | Lock Acquisition Interferometer   |
| LAL                    | LIGO Algorithm Library  |
| LAMT                   | Louisiana Association of Math Teachers  |
| LAN                    | Local Area Network  |
| LAS                    | Lock Acquisition System   |
| LASTI                  | LIGO Advanced Systems Test Interferometer (test facility at LIGO/MIT)   |
| LBA                    | Lanthanum- $\beta$ -Aluminate (a form of sapphire)  |
| LCGT                   | Large Cryogenic Gravitational-wave Telescope (planned Japanese GW detector)   |
| LDAS                   | LIGO Data Analysis System   |
| LDG                    | LIGO Data Grid  |
| LDR                    | Laser Diode Room  |
| LEA                    | Laser Enclosure Area  |
| LExC                   | LIGO (LHO) Exploration Center - proposed science center at LHO  |
| LG                     | Laguerre-Gauss (typically refers to a circularly symmetric basis)   |
| LHAM                   | Horizontal Access Module at Louisiana Site  |
| LHO                    | LIGO Hanford Observatory  |
| LIGO                   | Laser Interferometer Gravitational Wave Observatory   |
| LIGO-A                 | Study of implementation of an Advanced LIGO detector in Australia   |
| LIGO-SEC               | LIGO Science Education Center   |
| LISA                   | Laser Interferometer Space Antenna  |
| LLO                    | LIGO Livingston Observatory   |
| LLOID                  | Low Latency Online Inspiral Detection   |
| LMA                    | Laboratoire des Matériaux Avancés - vendor for optical coatings in Lyon, France   |
| LMXB                   | Low-Mass X-Ray Binary   |
| LOE                    | Level of Effort (constant effort with no deliverables, i.e. Project Management)   |
| LOS                    | Large Optics Suspension   |
| LOSC                   | LIGO Open Science Center  |
| LSC                    | LIGO Scientific Collaboration; or, Length Sensing and Control subsystem   |
| LSO                    | Laser Safety Officer  |
| LSTA                   | Louisiana Science Teachers Association  |
| LTI                    | Linear, Time-Invariant (systems) have a transfer function that relates input to output.   |
| LVAX                   | LLO - Kantech definition of VEA-X   |
| LVAY                   | LLO - Kantech definition of VEA-Y   |
| LVC                    | LIGO Scientific Collaboration -Virgo Collaboration joint activities   |
| LVDT                   | Linear Variable Differential Transducer   |
| LVEA                   | Laser and Vacuum Equipment Area (at observatory corner stations) - This room houses PSL, BS, ITMX, ITMY among other things; Large Vacuum Enclosure Area |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation  |
|------------------------|--|
| LXI                    | LAN Extension for Instruments  |
| LZH                    | Laser Zentrum Hannover, partner with AEI for aLIGO lasers                              |
| m/rHz                  | meter per square root Hertz  |
| M&O                    | Maintenance and Operations   |
| M&O                    | Management & Operations  |
| MAP                    | Memory Allocation Pointer (reflected memory)   |
| MAST                   | Math and Science Teaching  |
| MATLAB                 | mathematical programming language  |
| MB                     | Megabyte   |
| MC                     | Mode Cleaner Optic (iLIGO - usually MCx, where x = {1,2,3}) - Stabilizes mode of laser |
| MCL                    | Mode Cleaner Length (Servo control signal)   |
| MCM                    | Mode Cleaner Mirror  |
| MCWFS                  | Mode Cleaner Wave-Front Sensor   |
| MD5                    | checksum to confirm digital data file integrity  |
| MDC                    | Mock Data Challenge  |
| mDV                    | MATLAB Data Viewer   |
| MEDM                   | Motif Editor and Display Manager (GUI for control screens)                             |
| MEPI                   | Magnetic External Pre-Isolator   |
| MESA                   | Mathematics, Engineering, Science Achievement  |
| MFLOPS                 | Mega (Million) Floating Point Operations Per Second                                    |
| MGASF                  | Monolithic Geometrical Anti-Spring Filter  |
| MICH                   | Michelson cavity length = $(l_x - l_y)$  |
| MIMO                   | Multiple Input, Multiple Output  |
| MISE                   | Modeling Inquiry Science Education Project   |
| MIT                    | Massachusetts Institute of Technology  |
| MKI                    | MIT Kavli Institute of Astrophysics & Space Research                                   |
| mm                     | millimeter   |
| MMT                    | Mode Matching Telescope - A beam expander that sets the laser to a particular mode     |
| MOPA                   | Master Oscillator-Power Amplifier -- low power 'seed' laser source                     |
| MOU                    | Memorandum of Understanding  |
| MP                     | Mass Position  |
| Mpc                    | Megaparsec   |
| MPE                    | Maximum Permissible Exposure (Laser Radiation)   |
| MPI                    | Message Passing Interface  |
| MRE                    | Major Research Equipment   |
| MREFC                  | Major Research Equipment and Facilities Construction (funding mechanism for aLIGO)     |
| MSP                    | Math Science Partnership   |
| MSPRC                  | Marginally Stable Power Recycling Cavity   |
| MSR                    | Main Storage Room  |
| MSU                    | Moscow State University  |
| MTBF                   | Mean Time Between Failures   |
| MTDC                   | Modified Total Direct Costs  |
| MTS                    | Master Timing System   |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation  |
|------------------------|--|
| MTTR                   | Mean Time To Repair  |
| MTU                    | Master Timing Unit (see TMU)   |
| MVSC                   | multi variate statistical classification   |
| MZ                     | Mach-Zender Interferometer   |
| $M_{\odot}$            | Mass of the Sun  |
| NA                     | Not Applicable; Not Available; Not Allowed   |
| NAT                    | Network Address Translation  |
| NB                     | Noise Budget   |
| NBI                    | Neutron Star Binary Inspiral   |
| Nd:YAG                 | Neodymium doped Yttrium Aluminum Garnet (laser gain medium)                          |
| NDS                    | Network Data Server  |
| NDS2                   | Gen-2 Network Data Server-streaming server of LIGO data for near real time analysis  |
| NDSG                   | NDS Gateway computer   |
| NHZ                    | Nominal Hazard Zone (Laser Radiation)  |
| NIC                    | Network Interface Card   |
| NLNM                   | New Low Noise Model (Peterson, 1993)   |
| NLT                    | Non-Linear Thermoelastic noise   |
| nm                     | nanometer  |
| NMR                    | Nuclear Magnetic Resonance   |
| NN                     | Newtonian Noise  |
| NPRO                   | Non-Planar Ring Oscillator   |
| NRSB                   | Non-Resonant Side Band   |
| NS                     | Neutron Star   |
| NS-NS                  | Neutron Star - Neutron Star  |
| NSBH                   | neutron-star-black-hole binaries   |
| NSBP                   | National Society of Black Physicists   |
| NSF                    | National Science Foundation  |
| NSHP                   | National Society of Hispanic Physicists  |
| NSPOB                  | Normalized Sideband Power On the Beam-Splitter                                       |
| NSTA                   | National Science Teachers Association  |
| NTP                    | Network Time Protocol  |
| OAF                    | Online Adaptive Filtering  |
| ODE                    | Ordinary Differential Equation   |
| OFI                    | Output Faraday Isolator (aLIGO Auxiliary optics element)                             |
| OL                     | Optical Lever  |
| OLMON                  | Out-of-Loop Monitor (monitor the intensity noise after the mode cleaner - PSL's ISS) |
| OMC                    | Output Mode Cleaner - Stabilizes mode in output laser                                |
| OOP                    | Object-Oriented Programming  |
| OPAMP                  | Operational Amplifier (from analog computer <i>operations</i> )                      |
| OPD                    | Optical Path Difference  |
| OPL                    | Optical Path Length  |
| OPO                    | Optical Parametric Oscillator (for use of squeezed light)                            |
| Optickle               | Frequency Domain IFO Simulator (Matlab)  |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation  |
|------------------------|--|
| OpLev                  | Optical Lever; sometimes OptLev (part of aLIGO AOS)  |
| ORACLE                 | Computer software used for data management at Caltech  |
| OSA                    | Optical Spectrum Analyzer  |
| OSB                    | Operations Support Building  |
| OSEM                   | Optical Sensor Electromagnetic Motor (suspension sensor/actuator unit) (Optical Shadow Sensor and Magnetic Actuator)           |
| OSG                    | Open Science Grid  |
| OTAS                   | OMC Thermal Actuation System   |
| OTF                    | Optics Test Facility at Caltech  |
| P3F                    | Payload Polar Positioning Fixture  |
| PAC                    | Program Advisory Committee   |
| PAP                    | Program Advisory Panel   |
| PB                     | PetaByte   |
| PCB                    | Printed Circuit Board  |
| PCIX                   | Peripheral Component Interconnect Extended (a computer standard for peripheral communication)                                  |
| PD                     | Photo Diode; Preliminary Design  |
| PDD                    | Preliminary Design Document  |
| PDE                    | Partial Differential Equation  |
| PDH                    | Pound-Drever-Hall (reflection locking technique)   |
| PDMWorks               | Product Data Management Works (SolidWorks CAD file repository and version control system)                                      |
| PDR                    | Preliminary Design Review  |
| PDRR                   | Preliminary Design Requirements Review   |
| PDT                    | Photo Detector   |
| PEM                    | Physical and Environmental Monitor - Includes weather stations, accelerometers, seismometers, microphones, temperature sensors |
| PEP                    | Project Execution Plan   |
| PGA                    | Programmable Gate Array  |
| PhCal                  | Photon Calibrator (part of aLIGO AOS)  |
| PI                     | Parametric Instability   |
| PIT                    | Pitch  |
| PLC                    | Plano-Convex Lens  |
| PLL                    | Phase Locked Loop  |
| pm                     | picometer  |
| PM                     | Phase Modulation; Project Management; Preventive Maintenance   |
| PMA                    | Physics, Math & Astronomy (academic division)  |
| PMC                    | Pre-Mode Cleaner   |
| PMP                    | Project Management Plan  |
| PMX                    | Particle Mobility Experiment   |
| PN                     | Post-Newtonian   |
| PNRO                   | Pacific Northwest Regional Observatory   |
| PO                     | Pick Off (usually in reference to a laser beam)  |
| POB                    | Pick Off Beam <splitter>   |
| POP                    | Pick Off Power (from Power Recycling Cavity)   |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation  |
|------------------------|--|
| POSIX                  | Portable Operating System Interface (IEEE Standard 1003.1)   |
| POX                    | Pick Off X Arm (at ITMX)   |
| PPE                    | Personal Protection Equipment  |
| ppm                    | parts per million  |
| PPS                    | Pulse Per Second - the timing heartbeat  |
| PR                     | Power Recycling Optic (usually PR <sub>x</sub> , where x = {M,2,3})  |
| PRC                    | Power Recycling Cavity   |
| PRCL                   | Power Recycling Cavity Length = $(l_p + (l_x + l_y)/2)$  |
| PRM                    | Power Recycling Mirror - Recycles light within the interferometer; Power Recycled Michelson                        |
| PRN                    | Pseudo-Random Noise  |
| PROM                   | Pockel's Readout Optical Modulator   |
| PSL                    | Pre-Stabilized Laser (detector subsystem)  |
| PTF                    | Palomar Transient Factory  |
| PTX                    | Power Transmitted X-arm  |
| PTY                    | Power Transmitted Y-arm  |
| PUM                    | Pen-Ultimate (3 <sup>rd</sup> level on quad SUS rack)  |
| PZT                    | Piezoelectric Transducer - Controls the position of one mirror in the OMC (works with HTR to obtain a single mode) |
| Q                      | Resonant system Quality factor (inverse of loss)   |
| QA                     | Quality Assurance  |
| QE                     | Quantum Efficiency   |
| QND                    | Quantum Non-Demolition   |
| QPD                    | Quadrant Photo Diode - Reads transmission of end mirrors and transmission through OMC (for alignment)              |
| QPD <sub>X</sub>       | Quadrant Photo Diode at the X-end station  |
| QPD <sub>Y</sub>       | Quadrant Photo Diode at the Y-end station  |
| Quad                   | Quadruple test mass suspension   |
| R                      | Reflectivity   |
| R&D                    | Research and Development   |
| R&RA                   | Research and Related Activities  |
| RAID                   | Removable Array of Independent Drives; Redundant Array of Inexpensive Disks  |
| RAM                    | Random Access Memory   |
| RBS                    | Reflective Beam Servo; Rutherford BackScatter  |
| RC                     | Radius of Curvature (of a Reflective Mirror); Recycling Cavity   |
| RCG                    | Realtime Code Generator  |
| RDRR                   | A good guffaw  |
| RDS                    | Reduced Data Sets  |
| REFL                   | Reflected Light Port on ISCT1 (REFL1 = 61MHz; REFL2 = 24 MHz ... may be backwards)                                 |
| REO                    | Research Electro-Optics (Company Name)   |
| RET                    | Research Experience for Teachers   |
| REU                    | Research Experience for Undergraduates   |
| RF                     | Radio Frequency  |
| RFM                    | Remote File Management   |
| RFP                    | Request for Proposal   |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation  |
|------------------------|--|
| RFPD                   | RF Photodiode  |
| RFQ                    | Request for Quote  |
| RGA                    | Residual gas Analysis  |
| RH                     | Relative Humidity  |
| RIN                    | Relative Intensity Noise   |
| RIPPLE                 | Research and Inquiry-based Physics Project with LIGO and the Exploratorium                   |
| RM                     | Recycling Mirror   |
| RMS                    | Root mean square   |
| ROC                    | Radius Of Curvature  |
| RODA                   | Record Of Decision Agreement   |
| RSB                    | Resonant Side Band   |
| RSE                    | Resonant Sideband Extraction   |
| RT                     | Real Time  |
| rtHz                   | square root Hertz  |
| s                      | Second   |
| S-LED                  | Superluminescent Light Emitting Diodes   |
| s/s                    | Samples/second   |
| S5                     | LIGO's 5th Science Run   |
| S6                     | LIGO's 6th Science Run   |
| SACNAS                 | Society for the Advancement of Chicanos and Naïve American Scientists                        |
| SAH                    | Sensor Actuator Head   |
| SAP                    | Sapphire Core Optics   |
| SAS                    | Seismic Attenuation System   |
| SBX                    | Sandbox  |
| SCSI                   | Small Computer Standard Interface  |
| SEI                    | Seismic Isolation  |
| SEI-GDS                | Seismic Isolation - Global Diagnostics System  |
| SEM                    | Scanning Electron Microscopy   |
| SGR                    | Soft Gamma Repeaters   |
| SH-GRB                 | Short Hard Gamma Ray Bursts  |
| SHG                    | Second Harmonic Generator (used in squeezing of laser light)                                 |
| SIMMS                  | Secondary Ion Mass Spectrometry  |
| SiO <sub>2</sub>       | Silicon Dioxide, fused silica, fused quartz  |
| SIOM                   | Shanghai Institute of Optical Materials  |
| SIS                    | Static Interferometer Simulation (Software)  |
| SLC                    | Stray Light Control  |
| SM                     | Suspended Steering Mirror (~4" diameter, simple sling suspension)                            |
| SMI                    | Simple Michelson Interferometer (aLIGO phase; beamsplitter and ITMs, with/without recycling) |
| SMO                    | Systems Mechanics & Optics   |
| Sn                     | Science Run n (for example, S6 is Science Run 6)   |
| SNL                    | State Notation Language (EPICS)  |
| SNR                    | Signal to Noise Ratio  |
| SOS                    | Small Optics Suspension - SOS is the support of steering mirrors in aLIGO                    |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation   |
|------------------------|---|
| SPI                    | Suspension Point Interferometer; Seismic Platform Interferometer  |
| SPOB                   | Sideband Pick Off Beam <splitter>   |
| SPRC                   | Stable Power Recycling Cavity   |
| SQL                    | Standard Quantum Limit  |
| SR                     | Signal Recycled   |
| sr                     | Steradian   |
| SRC                    | Signal Recycling Cavity   |
| SRCL                   | Signal Recycling Cavity Length = $(l_s + (l_x + l_y)/2)$  |
| SRD                    | Science Requirements Document; also iLIGO planned performance target  |
| SRM                    | Signal Recycling Mirror - makes resonant cavity for GW-induced sidebands to tune interferometer sensitivity                     |
| SRS                    | Software Requirement Specification  |
| SRx                    | Signal Recycling Optic designator (where $x = \{M,2,3\}$ ) (interferometer configuration)                                       |
| SSO                    | Single Sign On  |
| STAMP                  | Stochastic Transient Analysis Multi Detector Pipeline   |
| STEM                   | Science, Technology, Engineering & Mathematics  |
| STFC                   | Science and Technology Facilities Council (UK funding agency)   |
| StripTool              | A strip chart graphs tool   |
| STS                    | Streckeisen Tri-axial Seismometer (STS-1 leaf-spring, STS-2 inertial pendulum)  |
| STS2, Gurarp, Trillium | Seismic ground motion sensors manufactured by various vendors   |
| STU                    | Slave Timing Unit (see TSU)   |
| SUBR                   | Southern University of Baton Rouge  |
| SUP                    | Support Equipment   |
| SURF                   | Summer Undergraduate Research Foundation  |
| SUS                    | Suspension Subsystem (sometimes also Suspension assembly) which controls the position of the suspended optics (e.g., ETMs, MCs) |
| SUS-AUX                | Suspension Subsystem (sometimes also Suspension assembly) - Auxilliary Channels   |
| SUS/UK                 | Suspension - UK   |
| SUS/US                 | Suspension - US   |
| SVD                    | Singular Value Decomposition  |
| SW                     | Solid Works (computer aided design software)  |
| SWE                    | Society of Women Engineers  |
| SYS                    | System-wide Information; Detector Systems Engineering   |
| Ta2O5                  | Tantalum Pentoxide (the dielectric mirror material used for LIGO High Reflective coatings)                                      |
| TAMA                   | Japanese Interferometric Gravitational-Wave Project (in the Tama region of Tokyo)   |
| TAPIR                  | Theoretical AstroPhysics Including Relativity   |
| TAR                    | Travel Authorization Request  |
| TB                     | Terabytes   |
| TBD                    | To Be Determined; To Be Done  |
| TC                     | Tri-Cities area (Washington State)  |
| TCAC                   | TriCity Astronomy Club  |
| TCP                    | Transport Control Protocol  |
| TCS                    | Thermal Compensation System   |
| TDF                    | Technology Development Facility   |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation  |
|------------------------|--|
| TDS                    | Time Server Acronym? (Tedious)   |
| TEM                    | Transverse Electromagnetic Mode (frequency); Transimission Electron Microscopy   |
| TEM00                  | The lowest order Transverse Electromagnetic Mode possible that exhibits a Gaussian distribution of light across the laser beam |
| TFP                    | Thin Film Polarizer (optical hardware)   |
| TGG                    | Terbium-Gallium-Garnet (optical material used in Faraday Isolators)  |
| TIR                    | Total Internal Reflection  |
| TM                     | Test Mass (as in input test mass or end test mass)   |
| TMS                    | Transmission Monitor Suspension (to relay light in/out of ETMs; part of aLIGO AOS)   |
| TMU                    | Timing Master Unit (see MTU)   |
| TNI                    | Thermal Noise Interferometer (R&D Test interferometer at LIGO-Caltech)   |
| TOF/SIMMS              | Time-of-Flight Secondary Ion Mass Spectrometry   |
| TOP                    | Top (upper assembly of SUS structure)  |
| TP                     | Test Point   |
| TPM                    | Test Point Manager   |
| TPMAN                  | Test Point Manager   |
| TPT                    | Technology Planning Team   |
| TRB                    | Technical Review Board   |
| Tridium, Guraip, STS2  | Seismic ground motion sensors manufactured by various vendors  |
| Triple                 | Triple auxiliary optic suspension  |
| TSU                    | Timing Slave Unit (see STU)  |
| TT                     | Tip-Tilt (mirror) - Steering mirrors prior to OMC (2 total)  |
| TTFSS                  | Table Top Frequency Stabilization Servo  |
| TTL                    | Transistor-Transistor Logic  |
| TwinCAT                | The Windows Control and Automation Technology  |
| UDP                    | User Datagram Protocol   |
| UF                     | University of Florida  |
| UGF                    | Unity Gain Frequency   |
| UHV                    | Ultra High Vacuum  |
| UIM                    | Upper Intermediate (2 <sup>nd</sup> level stage on quad SUS rack)  |
| UL                     | Upper Limits, Underwriters Laboratory  |
| ULPA                   | Ultra Low Particulate Air (cleanroom vacuum cleaner)   |
| UNC                    | Unified Coarse (Screw Thread Standard)   |
| UNEF                   | Unified Extra Fine (Screw Thread Standard)   |
| UNF                    | Unified Fine (Screw Thread Standard)   |
| UTC                    | Coordinated Universal Time   |
| UUG                    | Universal Unity Gain?  |
| V                      | Vertical   |
| VCO                    | Voltage Controlled Oscillator  |
| VCSEL                  | Vertical-Cavity Surface-Emitting Laser   |
| VE                     | Vacuum Equipment (LIGO instrument chambers)  |
| VEA                    | Vacuum Equipment Area (at observatory mid and end stations) Houses ETMX and ETMY (LLO Kantech calls this LVA)                  |

## LIGO Abbreviations And Acronyms

| Abbreviation / Acronym | Meaning / Explanation  |
|------------------------|--|
| VIRGO                  | French-Italian Laser Interferometer Collaboration; Italian-French Laser Interferometer Collaboration, now with broader participation in Europe |
| VME                    | Versa Modular Eurocard (IEEE 1014)   |
| VMS                    | Violin Mode Sensor (element of aLIGO quad test mass suspension)  |
| VMware                 | Virtual Machine software   |
| VNT                    | eLIGO Vent Plan  |
| VOE                    | Virtual Observatory Event  |
| VP                     | View Port (vacuum chamber viewing windows)   |
| VPN                    | Virtual Private Network  |
| VPW                    | Vacuum Preparation Warehouse   |
| VRB                    | Vacuum Review Board  |
| VRB                    | Vacuum Review Board  |
| VSR3                   | Virgo's Science Run 3  |
| VSRM                   | Variable Signal Recycling Mirror   |
| W                      | Watt   |
| w                      | Gaussian beam radius parameter   |
| WA                     | Washington   |
| WAN                    | Wide Area Network  |
| WBS                    | Work Breakdown Structure   |
| WD                     | WatchDogs, software and hardware   |
| WFS                    | Wave Front Sensors   |
| WMAP                   | Wilkinson Microwave Anisotropy Probe   |
| WSU TC                 | Washington State University TriCities  |
| XAS                    | X-ray Absorption Spectroscopy  |
| XLR                    | Cannon "X" series, Latched, Rubberized connectors  |
| YV                     | Yakima Valley  |
| YVTC MESA              | Yakima Valley TriCities Mathematics Engineering and Science Achievement  |
| ZEMAX                  | Commercial optic-ray design software   |
| ZnSe                   | Zinc Selenide (material used in CO <sub>2</sub> laser applications; transmissive at the 10micron wavelength)                                   |