

**Edward W. Leaver**  
**Physicist, Scientific Programmer/Analyst**

www.edleaver.com

- Background in chemistry, physics, mathematics, and computation.
- Hyperspectral image endmember unmixing.
- Limb-sounding modeling on early parallel processor.
- Geoelectromagnetic modeling
- Anisotropic ray-tracing and seismic velocity modeling.
- Numerical analysis, optimization, data modeling and interpolation.
- Analytic and numerical solutions to differential equations.
- Circuit simulation and device modeling.
- Graphical User Interface design and development.
- Computer security and encryption
- Unix and Linux system programming and administration.
- Object-Oriented Design. Strong C/C++ and Fortran. Working familiarity with Php, Javascript, and Perl.

**Geophysics and Remote Sensing**

- Optimized unmixing of endmember coefficients in hyperspectral AVIRIS and SpecTIR HST airborne images. Program implements constrained linear SVD, non-linear Conjugate Gradient and/or Genetic Algorithm to invert the mixing equations. Parallelization is via Intel's Threading Building Blocks. Uses GDAL library for image input/output. Endmembers may be selected from USGS and JPL spectral libraries. C++ linked with Fortran libraries, GRASS GIS for mapping and image processing. (Icarus Resources 2008-2009)
- Computation of conductive layered-earth model electromagnetic impedance, reflection coefficients, and free-mode eigenfrequencies. C++ linked with Fortran libraries. (Icarus Resources 2009-2010)
- Developing anisotropic ray-tracing and seismic velocity modeling code for fracture event location and reflectivity characterization. C++ with Fortran libraries. (Icarus Resources 2006 - present).
- Wrote hypercube-based client-server module for planetary atmosphere infra-red spectral synthesis code, enabling investigators to rapidly evaluate different models of remote atmospheres as aid to interpretation of limb-sounding data collected by NASA space probes. Network programming, Fortran, C (JPL 1989).

- Coded hypercube load-balancing algorithm for particle-in-cell plasma simulation. Fortran (JPL 1989).
- Authored signal analysis program to compute electromagnetic ground-plane reflections at DoD test facility. VMS Fortran (BDM 1988).
- Significant advances in computational and analytic theory of Generalized Spheroidal Wave Functions. First accurate computation of black hole gravitational wave resonant frequencies. Defined general distribution of black hole resonance modes. Helped develop theory of resonant mode excitation (University of Utah 1980-1986).

### **Simulation and Modeling**

- Implemented implicit trapezoidal / ACT differential equation integrator for IBM's PowerSPICE circuit simulator. C++ (IBM 1998).
- Helped adapt Genetic Algorithm to optimize IBM BSIMPD mosfet device model parameters, and values for piecewise planar spline knots for IBM ACES high-speed circuit simulator C/C++ (IBM 2000 - 2001).
- Motivated improvements in IBM's loadable Simulator-Device API, and developed multivariate QVD spline package for fast device models and SOI body-voltage initialization. C++ (IBM 2001).
- Developed probabilistic distributed battle management algorithm for large-scale event driven SDI simulation; worked with programming team to implement on Caltech-JPL Hypercube parallel processor. C++ (JPL 1988-1990).
- Made first port of Sandia-Los Alamos Technical Exchange Committee's SLATEC Scientific Fortran subroutine library from CDC/VAX to Unix environment (JPL 1989).

### **Systems Programming**

- Developed interactive enterprise data archiving program for ProMAX seismic datasets. C++, Gtkmm GUI/support library, (Icarus Resources 2003 - 2008).
- Wrote commercial-quality license management daemon and application library. Sun RPC and BSD socket networking utilizing TCP and UDP transport protocols. Linux C++ (Icarus 2008).
- Senior programmer on distributed multi-platform access management product for major Unix security software suite. Saw project through several management and personnel changes to successful product launch. C, AIX, HPUX, OSF1, Solaris, SVR4, SunOS, Ultrix (Axent 1993 - 1995)



### **Interests**

Physics, chemistry, geophysics, remote sensing, climate and energy and related economic issues, electronics, hiking, music...

### **Education**

BA. Chemistry, University of Colorado (1974).

PhD. Physics, University of Utah. Outstanding Physics Graduate Student Award (1985).

Dissertation: "Solutions to a generalized spheroidal wave equation and an analysis of the quasinormal modes of Kerr black holes." Course work included Geology, Electrical Methods of Exploration, Seismology, Solid State Physics, Electronics, and Computational Chemistry.

**Publications:**

- E.W. Leaver, “An analytic representation for the quasinormal modes of Kerr black holes.” Proc. R. Soc. Lond. A. **402**, 285–298 (1985).
- E.W. Leaver, “Solutions to a generalized spheroidal wave equation: Teukolsky’s equations in general relativity, and the two-center problem in molecular quantum mechanics.” J. Math. Phys. **27**, 1238–1265, (1986).
- E.W. Leaver, “Spectral decomposition of the perturbation response of the Schwarzschild geometry.” Phys. Rev. D. **34**, 384–408 (1986).
- E.W. Leaver, “Quasinormal modes of Reissner-Nordström black holes.” Phys. Rev. D. **41**, 2986 (1990).
- E.W. Leaver, “Remarks on the continued fraction method for computing black hole quasinormal frequencies and modes.” Phys. Rev. D. **45**, 4713 (1992).
- E.W. Leaver, Comment on “High-overtone normal modes of Schwarzschild black holes” Class. Quant. Grav. **9**, 1643-1648 (1992).

**Conference Participation:**

- E.W. Leaver, *A new black hole radiation effect*, The 13th Texas Symposium on Relativistic Astrophysics (General Relativity poster session), Chicago, December 1986.
- E.W. Leaver, *Analytic and numeric properties of new representations for the radial generalized spheroidal wavefunctions*, SIAM 35th Anniversary Meeting, Denver, October 1987.
- C.B. Wallace, D.W. Harmony, R.C. Smith, J.C. McClune, R.E. Cabeen, and E.W. Leaver, *Nonlinear FCT simulations of MILO oscillators*, APS Division of Plasma Physics Thirtieth Anniversary Meeting (poster session), Hollywood, FL, November 1988.
- P.C. Liewer, E.W. Leaver, V.K. Decyk, and J.M. Dawson. *Concurrent PIC codes and dynamic load balancing on the JPL-Caltech Mark III hypercube*, 13th Conference on the Numerical Simulation of Plasmas (invited talk), Santa Fe, NM, September 1989.
- E.W. Leaver, P.C. Liewer, V.K. Decyk, and J.M. Dawson. *Dynamic Load Balancing of a Concurrent PIC Code*, APS Division of Plasma Physics Thirty-First Annual Meeting (poster session), Anaheim, CA, November 1989.
- E.W. Leaver. *Algebraic Specialty and Black Hole Normal Modes* Sixth Gregynog Relativity Workshop, Wales, UK, August 1993.

Have refereed for *The Physical Review*