

1. Judith Gamora Cohen

Professional Preparation:

Radcliffe College, BA, astronomy, 1967

California Institute of Technology, MS, 1969, astronomy

California Institute of Technology, PhD, 1971, astronomy

University of Arizona, BS, 1978, civil engineering

Appointments:

Kate Van Nuys Professor of Astronomy, California Institute of Technology, 2005 – present

Professor of Astronomy, California Institute of Technology, 1988 – 2005

Associate Professor of Astronomy, California Institute of Technology, 1979 – 1988

Assistant Astronomer, Kitt Peak National Observatory, 1974– 1978

Miller Postdoctoral Fellow (University of California at Berkeley), 1971-1974, astronomy

Honors and Awards:

Member, National Academy of Sciences, elected May 2017

Cecilia Payne-Gaposchkin Distinguished Lecture, Center for Astrophysics,

. Harvard University, 5/2011

Caroline Herschel Distinguished Lecture, Space Telescope Science Institute, 3/2006

Fullam Award of the Dudley Observatory, 2000

Society Memberships:

American Astronomical Society, International Astronomical Union

Selected Service for Caltech:

Founder, Caltech Recycling Center, 1985

Faculty Sponsor, Caltech/Pasadena Folk Music Society, 1985 - present

Chair, Faculty Committee on Public Events, 2003 – 2012

Chair, Committee for Upperclass Admissions, 2006 – 2008

Member, Science Steering Committee, Keck Observatory, 2001 – 2004, 2009 – present

Co-Chair, Science Steering Committee, Keck Observatory, 2013 – present

Member, Science Advisory Committee, Thirty Meter Telescope Project, 2004 – present

Caltech Member Representative to AURA, 2010 – present

Selected Service for the Astronomical Community:

Member, Webber Award Committee for the AAS, 2001 – 2001, Chair 2002 –2003

Member, AURA Oversight Committee for the Gemini Observatory, 2005 – 2011

Member, Oversight Committee for Spitzer, 2006 – 2011

Selected Major Instrument Development and Design Projects:

Low Resolution Imaging Spectrograph (first light instrument for Keck Observatory)

J.B. Oke, J.G. Cohen, and their Caltech-based engineering team,

. J.G.Cohen – PI of LRIS since 1994

MAGIQ project scientist (MAGIC = next generation guider at Keck), 2004 – present

Co-Chair, Galactic Archeology Project of the Prime Focus Spectrograph at the

. Subaru Telescope, 2011 – present

Major Scientific Contributions:

- First detailed models of the integrated light optical and infrared emission of old composite stellar systems as a function of metallicity based on detailed evolutionary tracks, with inputs based on extensive study of individual stars in Galactic globular clusters. These were applied to the Milky Way globular cluster system, to clusters in the Magellanic Clouds and in M31, as well as to elliptical galaxies. Demonstration that luminous elliptical galaxies are old and metal-rich, often with super-solar abundances. First demonstration of key role new field of infrared photometry can play in determining characteristics of composite stellar systems, and that the integrated light of old stellar systems from the visual to 2.3μ is well understood. (Aaronson, M., Cohen, J.G., Mould, J. & Malkan, M., 1978, ApJ, 223, 824; Frogel, J.A., Cohen, J.G. & Persson, S.E., 1983, ApJ, 275, 773)
- Together with J.B.Oke, led a team of Caltech-based engineers to design and build the Low Resolution Imaging Spectrograph, one of three first light instruments for the Keck Observatory. PI of LRIS since 1994. LRIS is still heavily used at the 10 m Keck I Telescope. (J.B.Oke, J.G.Cohen, M.Carr, et al, 1995, PASP, 107, 375)
- Discovery of gravitational settling and radiative levitation among hot horizontal branch stars, both important for detailed stellar and solar evolutionary calculations, including reconciling helioseismology vs solar abundances as well as Big Bang nucleosynthesis vs stellar Li abundances. (B.B.Behr, J.G.Cohen, J.K.McCarthy & S.G.Djorgovski, 1999, ApJ Lett., 517, L135)
- Led the Caltech Faint Galaxy Redshift Survey, the first systematic exploration of the Universe that reached back in time to $z \sim 1.1$, and provided more than 670 galaxy

redshifts for objects in the Hubble Deep Field, discovered that large scale structure extends out to redshift 1, that star formation is downsized such that at the present epoch, low luminosity galaxies have high star formation rates while most high luminosity galaxies show an old stellar population with low star formation rates, but at high redshift, luminous galaxies show high star formation rates, derived the merger rate among galaxies out to $z \sim 1$, their luminosity evolution, and the evolution of their spectral energy distribution. (J.G. Cohen, D.W. Hogg, M.A. Pahre & R. Blandford, 1996, ApJ Lett., 462, L9; Hogg, D.W., Cohen, J.G., Blandford, R. & Pahre, M.A., 1999, ApJ, 504, 622; Cohen, J.G., 2002, ApJ, ApJ, 567, 672)

- Demonstrated burning of C into N in all Galactic globular clusters examined extends from the RGB tip to below the main sequence turnoff, a key step in the development of the concept of multiple stellar populations in globular clusters. Further evidence for this from a detailed study of the Mg isotope ratios. (Judith G. Cohen, Michael M. Briley & Peter B. Stetson, 2005, AJ, 130, 1177; J.Melendez & J.G.Cohen, 2009, ApJ, 699, 2017)
- Led the 0Z project to study the local high-redshift universe through stellar archeology; datamining the Hamburg/ESO Survey to establish a large sample of extremely metal-poor halo field stars, determine their trends in metallicity for many elements. Established their small deviations about trends consistent with uncertainties. Found a very small set of outliers, some of which represent new types of extremely metal-poor stars. Established the first reliable determination of the metallicity distribution function at very low metallicity in the halo. (Cohen, Christlieb, McWilliam et al, 2004, ApJ, 612, 1107; J.G., McWilliam, A., Christlieb, N., et al, 2007, ApJ Lett., 659, L25; Schorck, T., Christlieb, N., Cohen, J.G. et al, 2009, A&A, 50, 817)
- The first demonstration that the inner halo globular clusters, and most of those in the outer halo, follow the abundance trends shown by halo field stars, and that the same holds for the most metal-poor stars in the classical dSph satellites of the Milky Way. Discovery of a significant population of stars with $[\text{Fe}/\text{H}] < -3$ dex in the classical dSph Galactic satellites, all of which sheds light on the early history of the Milky Way and the formation of the Galaxy through hierarchical mergers. (J. Cohen & J. Melendez, 2005, AJ, 129, 303; J. Cohen & J. Melendez, 2005, AJ, 129, 1607; Cohen & Huang, 2010, ApJ, 719, 931)
- The first use of high precision abundances to search for stars hosting exoplanets. The technique is to locate solar twins, i.e. stars as similar to the Sun as possible. One then derives very precise abundances in the solar twin to look at the abundances of the refractory elements in the star compared to the Sun. If there is a dependence of enhancement in the stellar abundances as a function of increasing condensation temperature, one explanation might be that this was produced by adding a typical-mass rocky planet to the convection zone of the star, thus suggesting the star hosts exoplanets. (The Remarkable Solar Twin HIP 56948: A Prime Target in the Quest for Other Earths, J. Melendez, M. Bergemann, J.G.Cohen, et al, 2012, A&A, 543, A29)

- Current scientific interest: With postdoctoral fellows Branimir Sesar and Nina Hernitshek, using large samples of RR Lyr (a type of pulsating variable star whose distance can be determined to a precision of a few percent directly from its lightcurve) datamined from the Palomar Transient Facility and more recently from the Pan-STARRS survey to characterize the stellar content and dark matter distribution in the outer halo of our Milky Way galaxy.

Eight Significant Publications Since 1995:

“The Keck Low Resolution Imaging Spectrometer”, *PASP*, **107**, 375, 1995 (authors J.B.Oke, J.G.Cohen, M.Carr, J.Cromer, A.Dingizian, F.H.Harris, S.Labrecque, R.Lucinio, W.Schaal, H.Epps, and J.Miller)

“Caltech Faint Galaxy Redshift Survey X: A Redshift Survey in the Region of the Hubble Deep Field North”, Judith G. Cohen, David W. Hogg, Roger Blandford, Lennox L. Cowie, Esther Hu, Antoinette Songaila, Patrick Shopbell & Kevin Richberg, 2000, *ApJ*, **538**, 29

“Caltech Faint Galaxy Redshift Survey XIII: Spectral Energy Distributions for Galaxies in the Region of the Hubble Deep Field North”, J.G.Cohen, 2001, *AJ*, **121**, 2895

“Abundances in a Large Sample of Stars in M3 and M13”, 2005, J. Cohen & J. Melendez, *AJ*, **129**, 303

The Rise of the AGB in the Galactic Halo: Mg Isotopic Ratios and High Precision Elemental Abundances in M17 Giants, 2009, J. Melendez & J.G.Cohen, *ApJ*, 699, 2017

“The Chemical Evolution of the Ursa Minor Dwarf Spheroidal Galaxy”, 2010, J. Cohen & W. Huang, *ApJ*, 719, 953

“Normal and Outlying Populations of the Milky Way Stellar Halo at $[Fe/H] < -2$ ”, 2013, Cohen, J., Christlieb, N., Thompson, I. et al, *ApJ*, 778, A56

“The Nature of Hypervelocity Stars and the Timescale Between Their Formation and Ejection”, 2012, W.R.Brown, J.G.Cohen, M.J.Geller & S.J.Kenyon, *ApJL*, 754, L2

J. Cohen and J.B.Oke led the team that designed and built the Low Resolution Imaging Spectrograph, one of 3 first light instruments for the Keck Observatory. J. Cohen, from 1991 to 1997, wrote more than 700 pages of technical reports on the design, software, performance, etc of the LRIS. These reports were circulated within the Keck community and some are available through the Keck WWW LRIS home page.

Selected Older Significant Publications:

“A Coude Camera for Image Tube Work”, 1977, Cohen, J. G., Simmons, S. E. & Maney, S., PASP, 88, 966

“Confirmation of the Presence of Iron Hydride in Sunspots and Cool Stars”, 1977, Wing, R., Cohen, J. & Brault, J.W., Ap.J., 216, 659

“Near-Infrared Luminosity-Sensitive Features in M Dwarfs and Galaxies”, 1978, Cohen, J., Ap.J., 221, 788

“Calibration of Metallicity Effects on the Integrated Colors of Globular Clusters and Early Type Galaxies”, 1978, Aaronson, M., Cohen, J. G., Mould, J. & Malkan, M., Ap.J., 223, 824

“Globular Cluster Giant Branches and the Metallicity Scale”, 1983, Frogel, J., Cohen, J. & Persson, S. E., Ap.J., 275, 773

The FIGARO Package for Astronomical Image Processing, (invited paper for meeting in Santa Cruz, June 1987), in *Instrumentation for Ground Based Astronomy*, ed. L. B. Robinson (Springer Verlag), 448, 1988

Graduate Students and Postdoctoral Fellows Supervised:

Graduate students supervised: Lin Yan (PhD 1995), Brad Behr (PhD 2000) (total: 2)

Postdoctoral fellows supervised: Tim Beers, John Blakeslee, Inese Ivans (Hubble Fellow), Jorge Melendez, Solange Ramírez, Patrick Shopbell, Wenjin Huang, Evan Kirby (Hubble Fellow), Branimir Sesar, and Nina Hernitschek (total number: 10)

Mentors: Guido Munch (PhD) (Caltech, retired), J.B.Oke (instrument design and construction) (Caltech, deceased)