

COMMITTEE ON FACULTY RESEARCH LECTURE
Annual Report, 2010-2011

To the Academic Senate, Santa Cruz Division:

The Senate Committee on the Faculty Research Lecture (CFRL) enthusiastically nominates Professor Steven S. Vogt of the Department of Astronomy and Astrophysics and the University of California Observatories to deliver the 2011 - 12 Lecture.

Steve Vogt is an astronomer and a builder of instruments who has greatly expanded our view of the inhabitable universe. During his 33 years of affiliation with UCSC, including 23 years as Professor and 5 as Distinguished Professor, he has designed, built, and used high precision spectrometers to find new worlds outside our solar system. Indeed he, his instruments, and his students have discovered more of the over 500 known extra-solar planets than anyone else.

Vogt received his Bachelor's Degree in Physics and Astronomy from the University of California Berkeley in 1972, and his Master of Science and PhD degrees from the University of Texas, Austin in 1975 and 1978 respectively. He then joined the faculty of UCSC and the Lick Observatory in 1978, straight out of graduate school.

In the 80's, he was responsible for building the Hamilton spectrometer at Lick Observatory with which many of the first extra-solar planets were discovered. His first graduate student, Geoff Marcy (PhD UCSC, 1982) was instrumental in many of these discoveries and went on to become a well-known planet finder himself. In 1994, Vogt further optimized the Hamilton spectrometer to the point where it could detect stellar "wobbles", variations in a star's speed towards or away from us induced by its orbiting planets, with a precision of only 3 meters per second. For comparison, Jupiter induces a wobble in our own sun's motion of about 12 meters per second. With this more precise spectrometer, many new planets were found.

Finding extra-solar *planets* was a great accomplishment, but Vogt's goal has always been extra-solar *Earths*, not Jupiters. This required greater precision - a bigger telescope and a better spectrograph. Jupiter's mass is 318 times that of the earth and the smaller planets cause smaller wobbles. So, in the 90's, Vogt's primary focus moved to the giant Keck telescopes in Hawaii. Using the new High Resolution Echelle Spectrograph (HIRES) that he developed, he was able to achieve a precision of 1 meter per second, about the speed at which we walk. This increased precision led to the discovery of a number of rocky planets with masses of only 5 - 10 earth masses. That's better, far smaller than Jupiter, but to induce a significant wobble and be detected in a short time, these planets had to be situated so close to their parent stars that there could be no liquid water. Vogt wanted to find watery earths like the one we live on, but the search was slow due to the scarcity of valuable Keck telescope time. Finding planets takes continued observations of the same star, sometimes for years, with an uncertain outcome.

And so, starting in 2003, Vogt moved much of his research back to Mt. Hamilton where he became Principal Investigator for a new telescope, indeed a new *kind* of telescope, the Automated Planet Finder (APF). At a cost of \$10 million, the APF began operation last year. The APF is capable of studying radial stellar speeds of just 1 meter per second, like HIRES, but on a continual basis. True to its name, the APF is actually a computer at heart. It *automatically* observes a set of candidate stars all night, every clear night, searching for evidence of planets in the 1 to 20 earth mass range. The initial search list includes 1000 stars which will be narrowed to 100 for careful follow-up studies. The APF is the only telescope of its kind and its survey will go on for years. It is just getting started. Meanwhile Vogt has also continued to use HIRES.

An important breakthrough came in 2010 when, using HIRES, Vogt's team discovered Gliese 581g. With a radius only about 50% larger than the earth and a mass about three times the earth, Gliese 581g, one of six planets orbiting the star Gliese 581, was in the "Goldilock's zone", not too hot, not too cold, not too big and not too small. Water would be a liquid on its surface and its gravity would not be very different from the Earth. Having two Earth-like planets (one being the Earth itself) within a region only 30 light years across, and poorly sampled so far, would have far reaching implications for the probability of life elsewhere. There would be billions of potentially habitable planets in the Milky Way galaxy alone (and we know of billions of other galaxies).

Unfortunately, in just the last few months, the discovery of Gliese 581g has become controversial. A team of Swiss astronomers who think they should see the planet in their data, if it's there, don't see it. So today, the community is divided on its existence. Such is science. With time, the planet will either become a certainty and Vogt will be very famous, or, if not, others like it will be discovered, quite probably by Vogt himself using the APF.

For many years, Vogt has also been a very popular instructor in Astronomy 2, the Astronomy Department's largest enrollment undergraduate class. He has also received numerous outside awards for his research, among them the Tinsley Prize of the American Astronomical Society (2002) and the Carl Sagan Memorial Award of the Planetary Society (shared with Marcy and Butler, 2002). He also shared the Prix Andre Lallemand of the Academie des Sciences de France with Nelson (1998) and received the Muhlmann Award of the Astronomical Society of the Pacific (1995). In 2004 he was selected Alumnus of the year by the University of Texas at Austin.

Therefore, in recognition of Professor Vogt's extraordinary research accomplishments, the Committee recommends that he be invited to deliver the 2010-11 Faculty Research lecture to the UCSC and Santa Cruz communities.

Respectfully submitted;

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