LSST E-News July 2010 • Volume 3 Number 2

Kevin Covey – Mapping a Path to Stellar Science


Astronomer Kevin Covey, co-chair, LSST Stellar Populations Science Collaboration Team

Astronomer Kevin Covey co-chairs the LSST Stellar Populations Science Collaboration Team, but he could easily have a second career as a cartographer. From mapping out the formation and evolution of low-mass stars, to establishing the path to stellar science with the LSST, to providing his students with the bearings they need to blaze their own trails, Kevin works hard to identify the right path from point A to point B.

Kevin, now a Hubble Fellow at Cornell University, spends his days (and nights) studying the formation and evolution of low-mass stars. A central focus of his research is to understand how a star's angular momentum changes over time. Kevin studies how the youngest stars exchange mass and angular momentum with their circumstellar disks and how those interactions might influence planet formation within the disks. He also tracks how stellar rotation evolves following the dissipation of circumstellar disks, helping calibrate a "rotational clock" to estimate the ages of individual stars in the Milky Way. "Each of these problems is interesting in its own way, but tackling them together allows me to map out the processes that affect a star's angular momentum from cradle to grave."

Kevin and his collaborators conduct time-domain surveys of stellar clusters at various ages to detect the brightness changes that result when a starspot moves across a star's face. The Young Stellar Object Variability (YSOVAR) Survey obtains multi-epoch, mid-infrared images of 11 young clusters. These data enable scientists to measure rotation periods and disk variability for stars too deeply embedded in their dusty nurseries for researchers to detect them in optical light. Kevin is also principal investigator on the Columbia/Cornell/Caltech-Palomar (CCCP) Open Cluster Survey. This survey uses the Palomar Transient Factory's unique capability for wide-field, multi-epoch imaging to measure the rotation of stars in old open clusters.

In addition to their diagnosis of stellar rotation, the YSOVAR and CCCP Open Cluster Surveys have also produced a wealth of ancillary science: identifying variable stars, eclipsing binaries, and surprisingly energetic stellar flares. These two projects also provide Kevin with experience "managing the fire hose of data" they produce.

LSST seemed a natural next step along Kevin's path. "I'm particularly interested in how LSST's deep, wide, homogeneous catalog will allow us to study the properties of young stars and track the evolution (and destruction) of the cluster they are typically born in." As co-chair of LSST's Stellar Populations Science Collaboration, Kevin works to understand the LSST system and helps to optimize its design and performance for Stellar Pops research programs. Over the past year he has helped project scientists include the lowest mass stars in the Milky Way in the synthetic images produced in Data Challenge 3b and beyond. He continues these efforts in collaboration with Jing Yee Chee, an undergraduate at Cornell, and Philip Cargile and Saurav Dhital, his Stellar Pops colleagues, by simulating LSST's ability to measure stellar rotation.

Kevin's career demonstrates the continuous value of investment in students and young researchers: "I had a fantastic REU (NSF's Research Experience for Undergraduates) experience with Ned Ladd at Bucknell University after my sophomore year at college." After Kevin modeled the substructure within the Taurus Molecular Cloud, they pointed the Haystack radio telescope at it and confirmed the prediction of the densest clump. "That was a powerful, formative experience for me: it still amazes me how much information we can extract about the properties of our universe from tiny amounts of light that happen to make it here to us on Earth."

Kevin now works to help his younger colleagues chart their own career paths. "The power of that REU experience has motivated me to develop opportunities for undergraduate students to become actively involved in research as early as possible. I work to help my students develop technical skills and insight about a research career early so they can focus their training toward whatever type of career they hope to build. I also get a lot out of the experience myself. The responsibility to be a good mentor pushes me to think through my projects more deeply than I might if I were to be the only one to be muddling through the results."

Kevin's map-making skills extend outside of his professional life: Kevin identifies promising routes for cycling tours that he enjoys when not indoors analyzing data, mentoring students, or helping prepare LSST for stellar population science. He has biked in the northwest (during the years he spent working on his PhD at the University of Washington) and on Cape Cod (with fellow Stellar Pops collaborator, Andrew West). This summer he'll be on the winding, hilly roads of New York State's Finger Lakes region, cycling and "letting my legs recover with strategically located rest stops at a few of the local wineries…"

These journeys have led Kevin to a great place in his career: "The folks I work with are great scientists, and even better people, so I probably shouldn't call what I'm doing these days 'work' – it feels more like working on a fun and exciting puzzle with good friends."

LSST is a public-private partnership. Funding for design and development activity comes from the National Science Foundation, private donations, grants to universities, and in-kind support at Department of Energy laboratories and other LSSTC Institutional Members:

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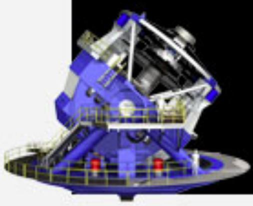

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