

Keivan Guadalupe Stassun – Colloquium Seminar – February 1, 2024  
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"The Royal Road, Redux: Eclipses and Transits in the Era of Gaia and TESS"

In his 1946 inauguration of the lectureship that now bears his name, Henry Norris Russell described eclipses as a "royal road" that "repays its followers richly." I begin by summarizing results from a number of rare, but astrophysically important eclipsing binary stars, that have paid richly in our understanding of (i) the effects of magnetic activity on the physical structure of low-mass stars and brown dwarfs, (ii) the role of triple systems in the formation and evolution of binaries, and (iii) the physics of surface convection in stars and its relation to stellar angular momentum evolution. Next, I describe how eclipsing binary stars serve as independent, empirical benchmarks for trigonometric parallaxes---with an accuracy of 200 micro-arcseconds or better that does not degrade with distance---and show an application of such a test to the Gaia parallaxes. I then describe a "pseudo-interferometry" approach by which the Gaia parallaxes, together with observations of granulation "flicker" in TESS light curves, permit the radii and masses of stars and planets to be measured with an accuracy of better than 5%, in an entirely empirical fashion. Finally, returning to Henry Norris Russell's famous H-R diagram as an example, I conclude with some remarks on the role of data visualization in scientific discovery, and describe new efforts to quantify neurodiverse visuo-cognitive capabilities (such as in autism) in order to teach humans and machines to make unexpected discoveries in data through visualization.