Response to Comment on “Stellar activity masquerading as planets in the habitable zone of the M dwarf Gliese 581”

Paul Robertson,1,2* Suvrath Mahadevan,1,2,3 Michael Endl,4 Arpita Roy1,2,3

Anglada-Escudé and Tuomi question the statistical rigor of our analysis while ignoring the stellar activity aspects that we present. Although we agree that improvements in multiparametric radial velocity (RV) modeling are necessary for the detection of Earth-mass planets, the key physical points we raised were not challenged. We maintain that activity on Gliese 581 induces RV shifts that were interpreted as exoplanets.

Accordingly, the period of Gliese 581 to be 130 days but physical. Our work clearly established the activity in Gliese 581 (e.g., this work) or by avoiding it [e.g., by using near-infrared spectra (8)].

3) Improvements in statistical techniques to not just detect signals but also to be able to disentangle Doppler RV signals from stellar activity–induced signals.

We agree that the ideal way to model RV data for multiplanet systems with stellar activity is to simultaneously model Keplerian orbits and activity signals/indicators as a single, multiparametric fit. We are well aware of these issues, as we have ourselves stated in another recent paper (9). There are a number of technical and scientific challenges to such an approach, most notably how to correctly parameterize and perform such a fit and how to best invoke the Gaussian process framework, which has been used successfully to describe stellar activity in recent work (10). The insidious impact of stellar activity—ever with relatively inactive stars like Gliese 581—is only now becoming apparent, and no widely recognized or accepted framework currently exists for treating it. As a first approach, our paper relied on the same statistical techniques as used by the studies that resulted in the original discoveries of the Gl 581 planets to show that accounting for activity already explains many of the puzzling aspects of the existing RV data. We and other members of the exoplanet community are eagerly working toward developing and implementing a more complete treatment.

REFERENCES


*Corresponding author. E-mail: pmr19@psu.edu

1) Better RV precision with new instrumentation, calibration, and reduction techniques.
Response to Comment on "Stellar activity masquerading as planets in the habitable zone of the M dwarf Gliese 581"

Paul Robertson, Suvrath Mahadevan, Michael Endl and Arpita Roy

*Science* 347 (6226), 1080.
DOI: 10.1126/science.1260974