

The Roman Road to Stellar Rotation: Rotation and Spots with Roman's Time Domain Surveys

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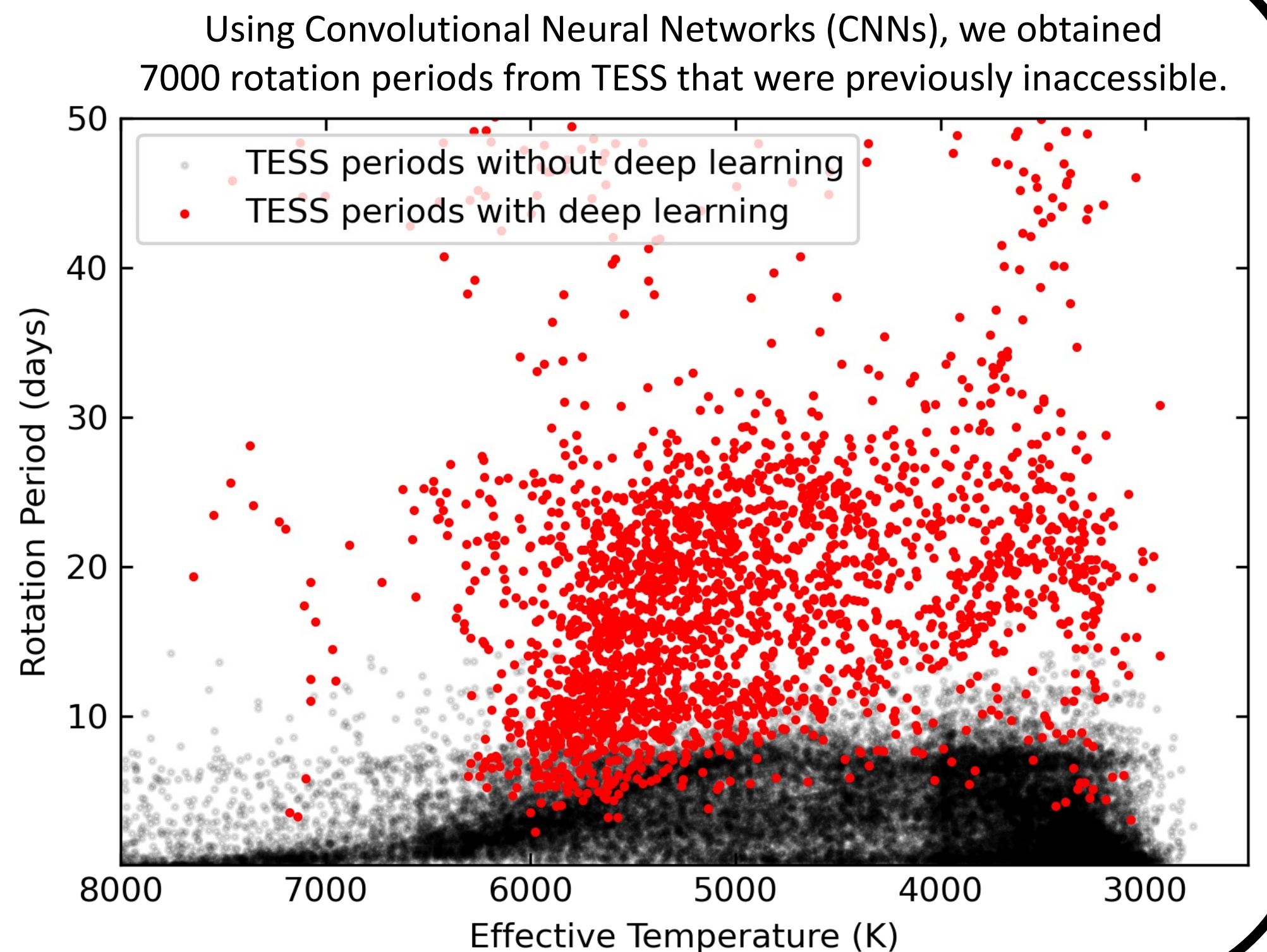
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Background

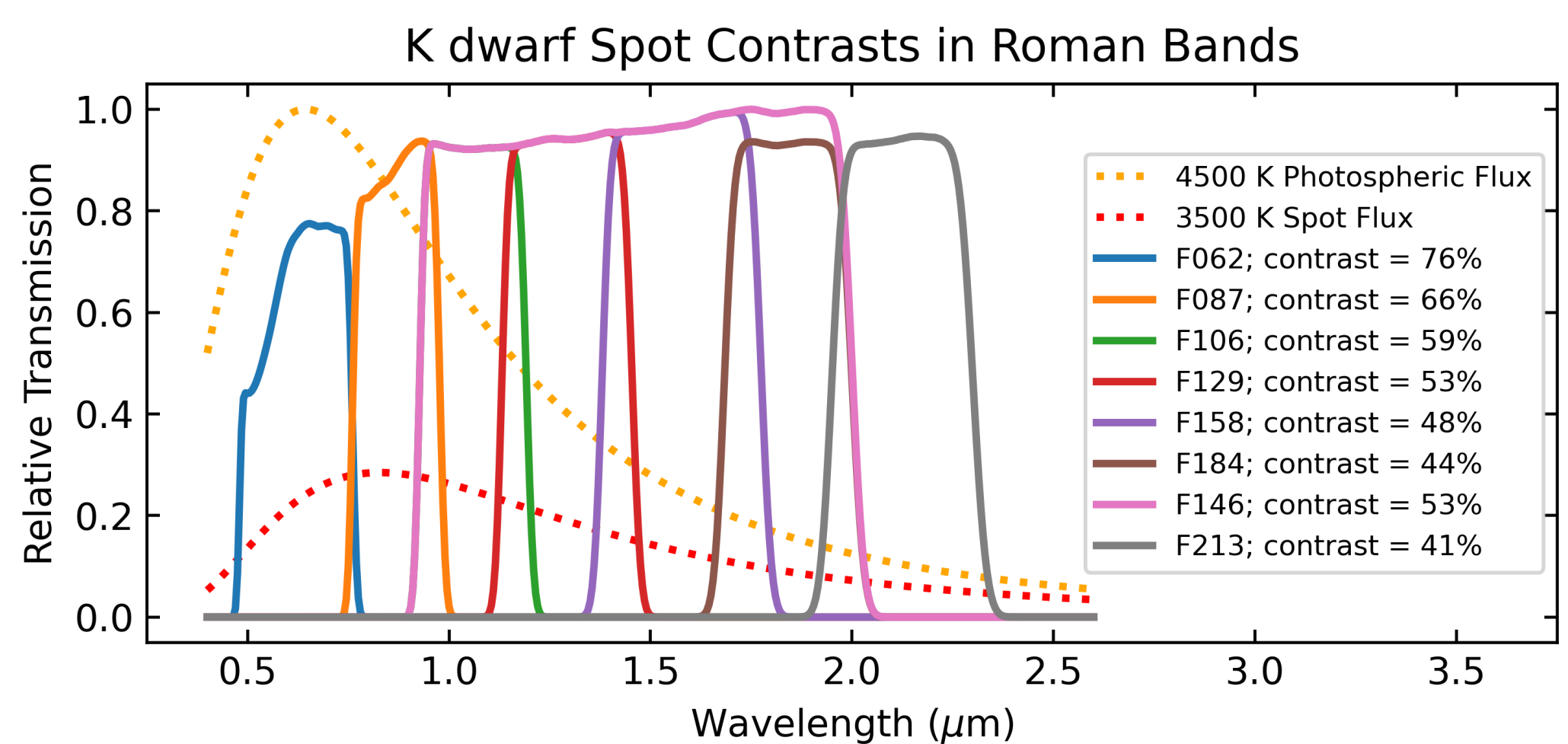
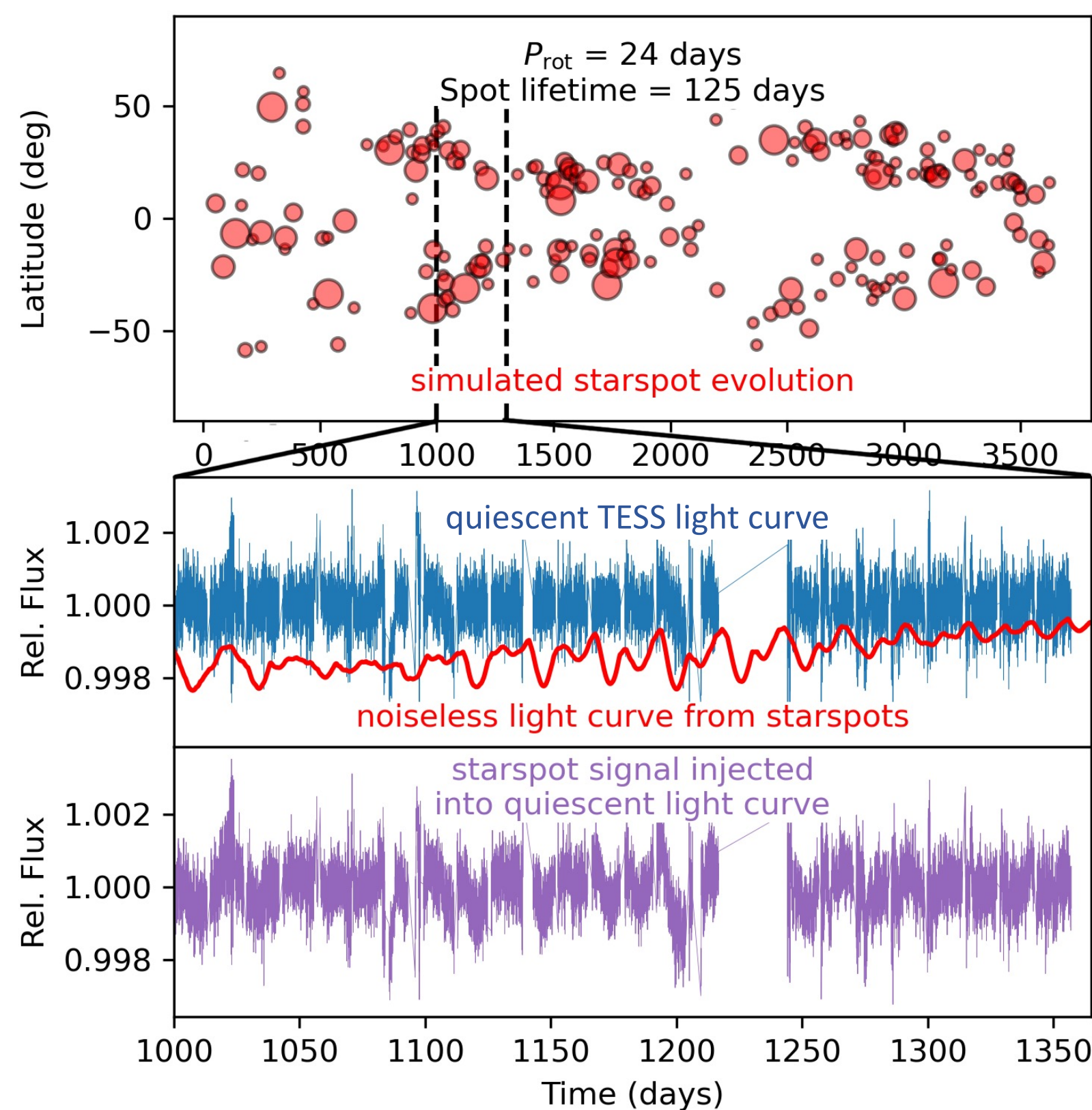
Rotation is a fundamental property of stars. It enables **precise age-dating** for Sun-like stars and is tied to **activity** and **magnetism**.

Large space-based time-domain surveys are prime sources of rotation periods, but their **complex observing strategies** can inhibit rotation signals.

We have used **Convolutional Neural Networks (CNNs)** to obtain 7000 rotation periods from **TESS**, and now we are adapting this framework to prepare for the **Roman Space Telescope**, which will provide **hundreds of thousands** of new periods.



Training Set



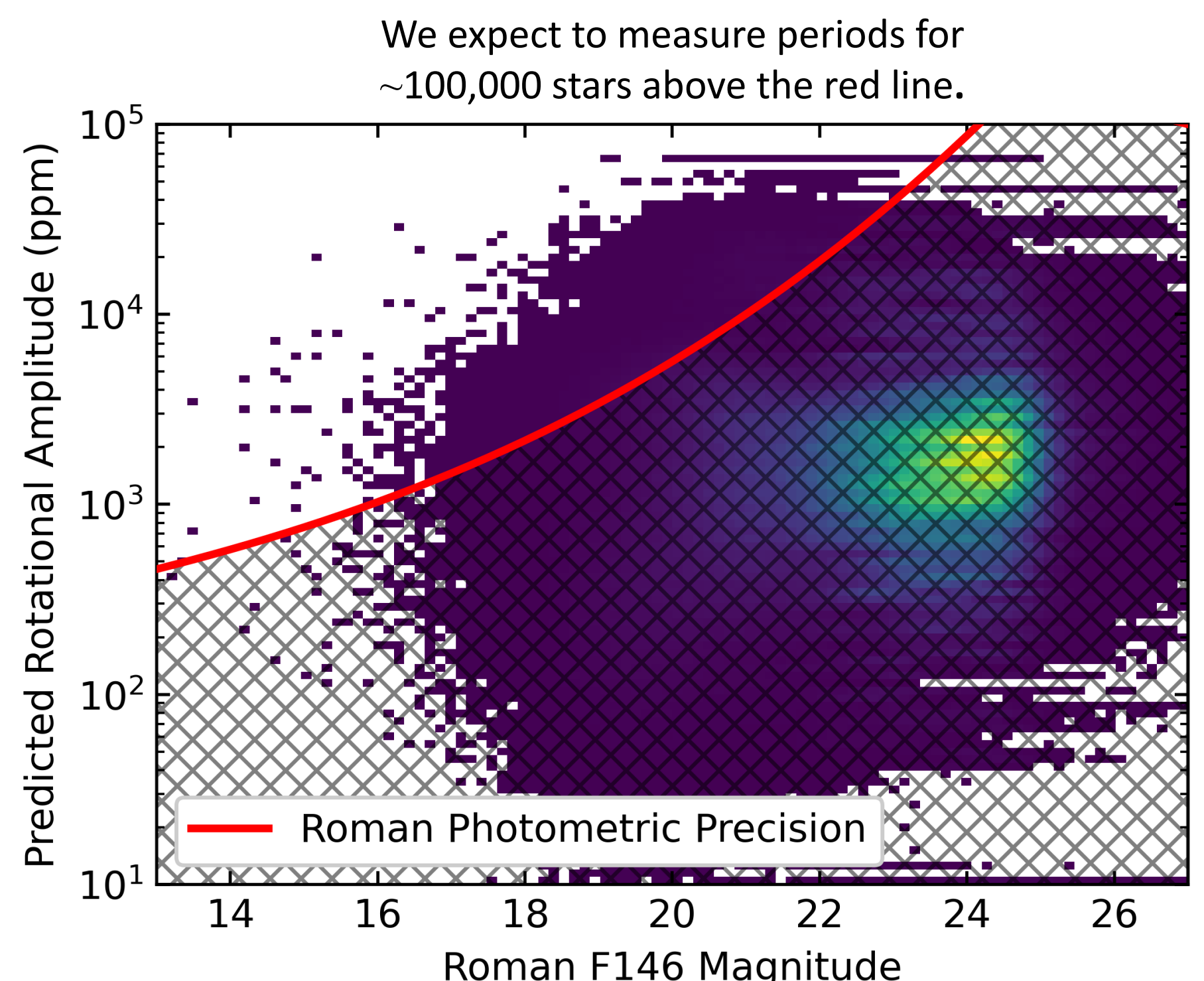
Like with TESS, we will simulate spot-modulated rotational light curves using the open source Python package **butterpy** and combine them with a quiescent “noisy” light curve. The training set will be publicly available from MAST under the **SMARTS** umbrella.

Roman will measure photometry in **multiple bands**, allowing us to see time-dependent **temperature changes** on stellar surfaces. For the first time, we will be able to infer **spot properties** for many thousands of stars!

Let's Talk Numbers

Roman will observe hundreds of millions of stars in its time-domain survey of the Galactic bulge, but most of those stars will likely be too faint to detect rotation. Because of the sheer number of stars observed, we expect to measure **~100,000 periods and spot temperatures**.

Exactly how many is subject to the observing cadence, time baseline, and choice of filters. **Using CNNs, we are determining which choices will maximize the period and temperature yields.**



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SMARTS Dataset