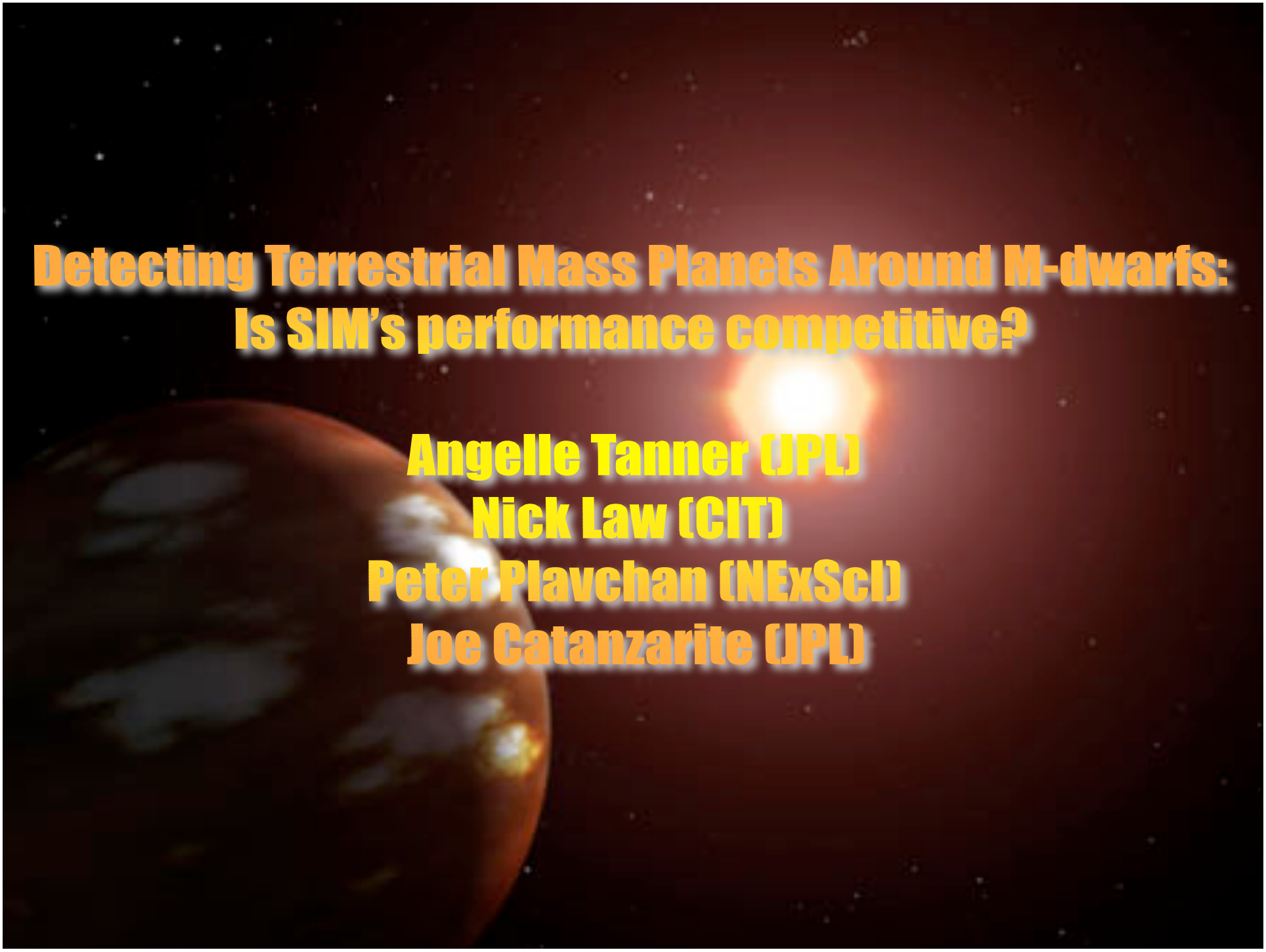

Detecting Terrestrial Mass Planets Around M-dwarfs:
Is SIM's performance competitive?
Angelle Tanner (JPL)
Nick Law (CIT)
Peter Plavchan (NExScI)
Joe Catanzarite (JPL)

Goals

- To assess the astrophysical limits of ultra-precision measurements of M dwarfs compared to other detection methods

- To assess the scientific impact of an M dwarf SIM GO survey to look for terrestrial planets

	Mass Msun	Lum Lsun	HZ AU	Period days
G2V	1	1	1.00	365
M0V	0.5	0.06	0.24	31.3
M3V	0.29	0.03	0.17	14.2
M6V	0.1	0.005	0.07	2.2
M9V	0.08	0.0002	0.01	0.2

1 $M_{\oplus}$ in HZ of Prox Cen produces 1.6 m/s and 19 μas

Program

1) Develop an Optimized M dwarf Target List
2) Model Stellar Activities Effect on Sensitivities

Considerations:
Jitter, Pulsations, Flares, Sunspots

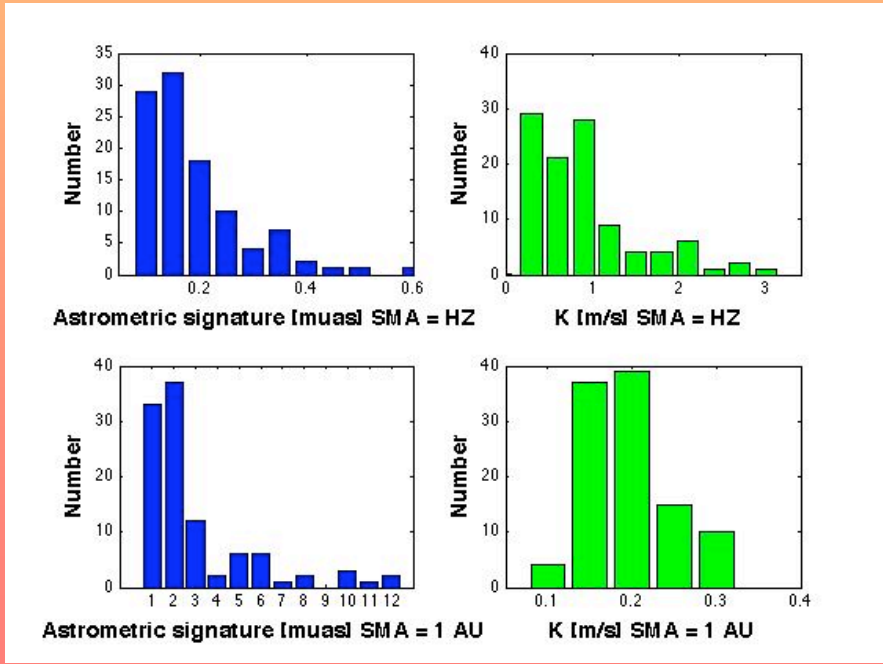
3) Derive Expected Planet Detection Results
4) Compare Results to RV surveys of 10-100 cm/s

Develop Optimized M dwarf Target List

Some notable nearby M stars:
Kapteyn's star, Wolf 359, GL 581

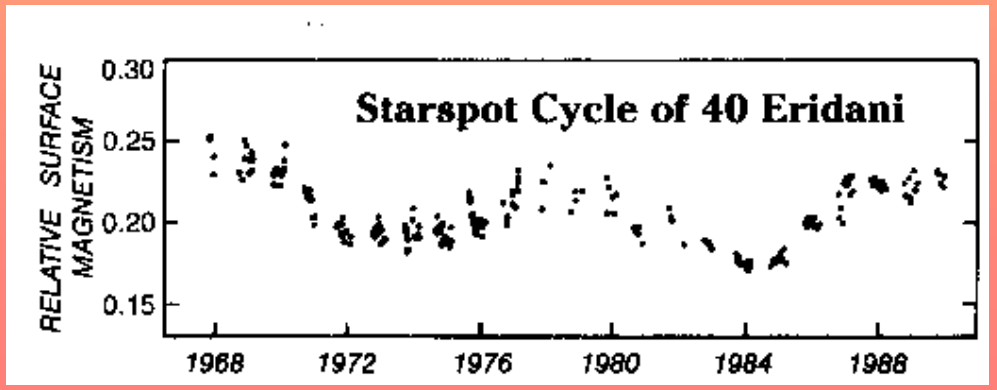
Properties of 100 nearest M dwarfs:
Distance: 3.29-20.15 pc
Mass: 0.15-0.65 Msun
Vmag: 5.64-12.0

Considerations:
Reference stars
Metallicity
Multiplicity

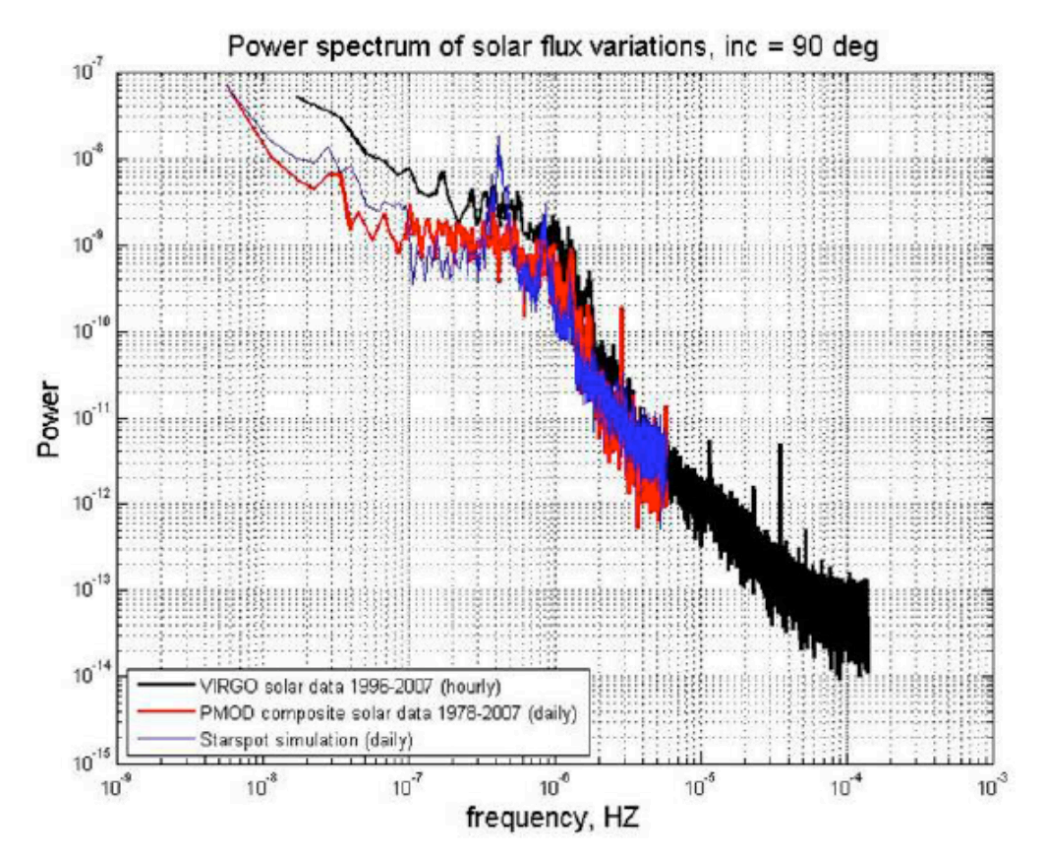


Model Effect of Stellar Noise

Types of noise:
Sunspots
Pulsations
Granulation
Flares



Work on Solar-Type Stars



Catanzarite et al. 2008

At 10 pc, solar sunspot noise results in a centroid jitter noise of 0.01-0.02 μas or 0.04-0.1 m/s

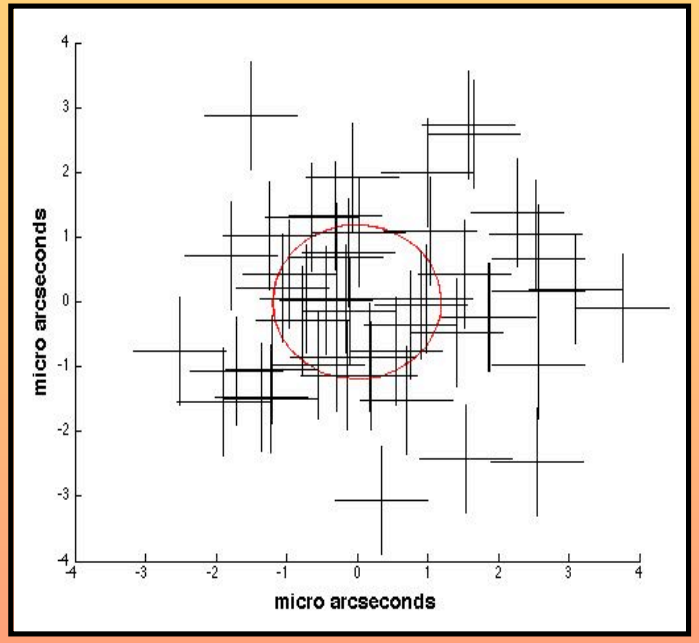
Utilize Space-Based Photometric Data

- HST (< 100 ppm) - GL 436
- MOST (few ppm) - GO call
- CoRoT (few ppm) - public release
- Kepler (< 1 ppm) - post SSS

Starspot model predicts magnitude variations of 10-100 ppm for the M dwarf GL 876

Derive Expected Planet Detection Results

Assumptions:
Input target list
Planet masses
Planet architectures
Astrometric sensitivity



1 Me, 0.1 Msun, HZ, 23 pc

- **Conduct Monte Carlo models on M dwarf sample**
- **Determine number of planets detected**
- **Determine minimum masses detected and accuracy of mass determinations**

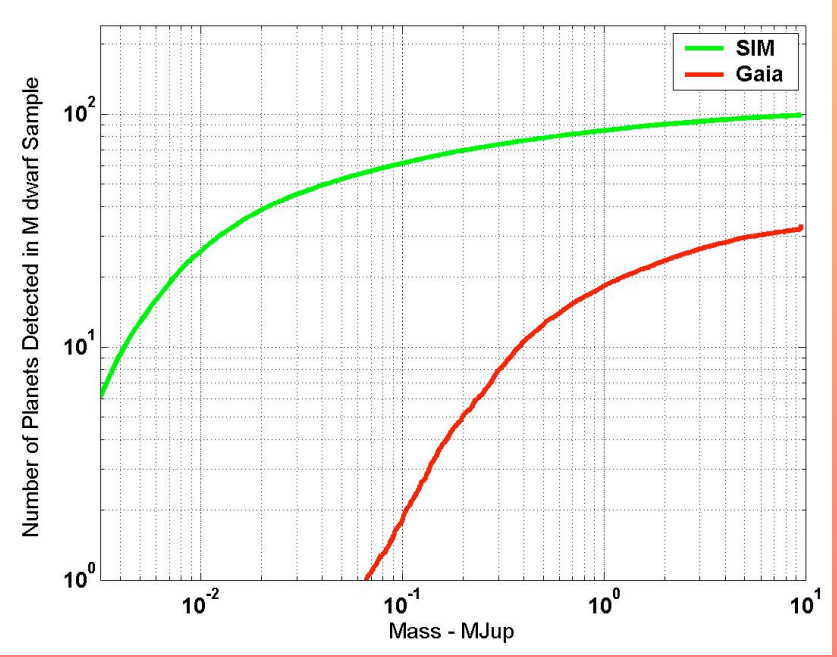
What SIM can do…

M dwarf Sample:

- 100 of the nearest M dwarfs taken from the RECONS survey (Henry et al. 2007)
- Distance = 1-10 pc
- SpTy = M1-M9V
- 7.3 < V < 15

SIM detects all planets with masses of 1-10 Me and periods of 0.2-5 years

And estimates 31% of their masses to within 30%



Final Products

- Optimized GO target list
- Extensive Jitter models
- Comparison to RV results
- Suggestions for synergy between methods