Future Capabilities of IRTF for Low-mass Stars, Brown Dwarfs and Exoplanetary Science

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IRTF’s Impact on VLMS/BD/EGP Science

Discovery
Classification
Physical Characterization
Cluster/moving group members
Rare pops (e.g., subdwarfs)
Binaries (resolved/unresolved)

Variability (weather & flaring)
Exoplanet transit/emission
Exoplanet/star RV curves
“Free-Floating” planet spectra
Model development & testing
Instrumentation (filters, design) etc.

Just SpeX:

![Graph showing publications over years]
IRTF’s Impact on VLMS/BD/EGP Science

PHDs:
Kimberley Aller (2016)  Mark Pitts (2011)
1084 late-M, L and T dwarfs within 30 pc of the Sun (symbol size indicates proximity)
**J1540-5101 (4.4 pc)**
Perez-Garrido (2014)

**J0720-0846 (6.0 pc)**
Scholz (2014); Burgasser et al. (2014); Mamajek et al. (2015)

**J1049-5319AB (2.0 pc)**
Luhman (2013); Burgasser et al. (2013, 2014)
Key Science: Planetary-Mass Members of Young Moving Groups

Need: high resolution IR & optical-IR spectroscopy

Theissen et al. (2018)
Young L3, 5-45 Myr (unk. association)
Mass ≈ 7-21 Jupiter masses
see also Allers & Liu (2013); Faherty et al. (2016)
Key Science: Planetary-Mass Members of Young Moving Groups

Need: high resolution IR & optical-IR spectroscopy

Gagne et al. (2017, 2018)
T2.5, $T_{\text{eff}} \approx 1100$ K @ 6 pc
member of 200 Myr Carina-Near
Mass $\approx 13$ Jupiter masses
Key Science: High-Res IR Spectroscopy – Abundances, B fields, Binaries

Souto et al. (2017) APOGEE data for Kepler-138

Triaud et al. (in prep) NIRSPEC data for substellar EB/SB2
Key Science: Multiples (AO/Astrometry)

Resolved Orbits (Sparse Aperture Mask)

Astrometric Orbits

Dupuy et al. (2015)
cf. Tuthill et al. (2006); Ireland et al. (2008)

Sahlmann et al. (in prep)
cf. Sahlmann et al. (2013); Lazorenko et al. (2014)
Key Science: Synoptic Spectroscopy – Transits & Weather

Schlawin et al. (2017)
Key Science: Synoptic Spectroscopy – Transits & Weather

Crossfield et al. (2014)
Data from VLT/CRIRES
The IRTF Spectral Library

Cushing et al. (2005); Rayner et al. (2009); Vacca et al. (in prep.), Villaume et al. (2017)

http://irtfweb.ifa.hawaii.edu/~spex/IRTF_Spectral_Library/

SpeX Prism Libraries Analysis Toolkit

Burgasser (2014, 2017)
https://github.com/aburgasser/splat/

Filippazzo et al. (2015)
http://database.bdnyc.org/query
IRTF Archive opens on IRSA this month...
Can IRTF improve the access/usage of archival data?

https://koa.ipac.caltech.edu

Keck DRPs: https://github.com/Keck-DataReductionPipelines
Summary of Recs for Ultracool Dwarf Science

• Desirable Instrumental Capabilities
  – VIS + IR simultaneous low-res spectrophotometry
  – Wide-field imaging/astrometry, suite of (multi-?) filters
  – AO spectro-/photo-/astro-metry (Robo-AO)
  – Multi-object spectroscopy? (long slit, IFU, μshutter, …)
  – “Rapid” Instrument switching?

• Desirable Products/Opportunities
  – An archive that provides more than raw fits files
  – Data reduction pipelines that are scriptable and move away from IDL (→ python, astropy/specutils)
  – New scheduling modes – very sparse sampling, partial-queue (scripts), “reserve” dry nights for MIR?