System Workshop III
NOAO and Gemini instruments
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NOAO Facility Strengths

- Mayall and Blanco = Wide Field, Natural Seeing, Broad $\lambda$: Mosaic’s, NEWFIRM, DEC (coming)
- WIYN = Wide field, with tip-tilt correction: WTTM+WHIRC, QUOTA $\iff$ ODI
- SOAR = Narrower field, good-to-enhanced image quality: Single object spectroscopy, optical & IR; GLAO (coming)
- SNe, Galaxy evolution, Stellar populations, Star & planet formation
Gemini Facility Strengths

- IR Sensitivity: NIFS, NICI, GNIRS
- High Spatial Resolution: Altair, NIFS, NICI, MCAO (coming), GPI (started)
- Faint Object, multiplexed spectroscopy: GMOS
- Exoplanets, Star & Planet formation, Brown dwarfs, Galaxy evolution
Selection Processes

- **Gemini:** Workshops (e.g., Aspen) lead to studies, which lead to RFP’s and bids
  - Gen-1 both solo and partnership
  - Gen-2 proposals all by partnerships
  - Strengths: all those of entire community

- **NOAO:**
  - System Workshop(s) identify priorities
  - Partners contribute resources + ideas: SAM, NEWFIRM, ODI (NB: Mosaic’s were last “on our own”)
  - Strengths …
  - Internal discussions begun re: “what next?” …
NOAO strengths: Opto-Mechanical Design, Fab, Testing
NOAO Strengths: Controllers and Detectors
NOAO Strengths: GLAO
SOIREE: Single Object O/IR
Extremely Efficient spectrograph

- $0.35 < \lambda < 1.6 \, \mu m$
  - $K$ more costly but possible
  - Cool how much for $\lambda$ range?
- $R \sim 3000$
- Throughput > 30%
- Rapid faint-object acquisition (slit-viewing guider? New TCS?)
- Use O & IR modes together or separately; 3+ channels
- Slit length $\sim 1'$
  - ADC? Need trade study
  - N&S? 'scope or internal?

Efficiency gains from:
- VPH gratings
- Modern dichroics
- Optimized coatings, detectors
SOIREE Science highlights

• Redshifts of rare/variable targets where wide wavelength coverage is required
  – GRBs, high z QSOs, core collapse SNe
• Reverberation mapping of QSOs
  – continuum and broad lines
• Redshifts where spectrum breaks $\sim 1 \mu$
• SN and CV spectrum monitoring
• Spectra of L,T,Y brown dwarfs
4CES: 4-meter Cryogenic Echelle Spectrograph

- $1 < \lambda < 5 \, \mu m$
- $R \sim 50,000$
- Slit 0.8” x 15”
- High Throughput
  - Si immersion grating
  - Single 2k x 2k array
- IR slit-viewer for acquisition & guiding
- Minimize modes, parts = minimize cost

Schematic of an accretion disk around a T Tauri pre-main sequence object
High Spectral Resolution near-IR Science

- Origin of elements of life
- Physics of star formation regions
- Accretion disks
- Chemistry of the ISM, especially H$_3^+$
- Masses for very low mass stars
- Astrochemistry of elementary life molecules, C$_2$H$_2$, HCN, …
- Flows in circumstellar envelopes
- Unique ISM, PN diagnostics: H$_2$, forbidden lines,…
- Magnetic fields, rotation, Doppler imaging,…
The Yin and Yang of 3-8 meter instruments

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<th>Instruments offering an order of magnitude gain rank well.</th>
<th>Expensive instruments have enormous inertia.</th>
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<td>New technologies spawn new instruments.</td>
<td>New technologies increase risk.</td>
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<td>Niche instruments may have “killer app” but still attract limited support.</td>
<td>General purpose capabilities attract universal support but lack “killer app”.</td>
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<td>No guaranteed funds for new instruments in a flat budget.</td>
<td>Good ideas attract funding.</td>
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