

BUDGET JUSTIFICATION

A. SENIOR PERSONNEL

0.5 calendar month of salary per year is requested for PI Craig Kulesa. His base salary is \$58,131 per 12-month fiscal year.

0.5 summer month of salary per year is requested for Co-PI Christopher Walker. His base salary is \$92,582 per 9-month academic year.

0.5 calendar month of salary per year is requested for Software Lead, William Peters. His base salary is \$74,517 per 12-month fiscal year.

1.0 calendar month of salary in year 1 is requested for Operations Manager, Brian Duffy. His base salary is \$65,918 per 12-month fiscal year.

B. OTHER PERSONNEL

0.25 calendar month of salary as temporary staff is requested for Cryogenics Engineer, Jack Cochran at a rate of \$45/hour.

Full funding for 3 years is requested for one graduate student (base salary \$30,175) engaged in Ph.D. thesis research under this project.

200 hours of undergraduate student research support is requested each year (base rate \$12/hour).

C. FRINGE BENEFITS

The following university-approved fringe benefit rates were applied to each labor category:

- Faculty/Appointed Personnel: 30.0%
- On Call/Temporary Staff: 10.0%
- Graduate Students: 59.5% composed of:
 - 9.5% for health/dental/life insurance
 - 50.0% for tuition remission (exempt from indirect cost charges)
- Undergraduate Students: 3.5%

D. CAPITAL EQUIPMENT

A 64-element RF filter set, used to shape the bandpass inside the IF processor system, will be purchased to replace the filter set that is currently used for CO J=3-2 currently. The new filter set will allow simultaneous observations in CO J=3-2 and HCO⁺ J=4-3, which is critical to this proposal. Vendors for the filter set are derived from the acquisition of the original set of filters. We have provided the relevant vendors (Lorch and Tiger) with detailed specifications and they in turn have provided preliminary costing information that is reflected in the budget. Once project funding commences, bids and purchase orders will be issued as appropriate.

E. TRAVEL

Domestic

Funds are requested for one domestic AAS conference for one graduate student for five days each year. Travel funds requested include roundtrip airfare (@ \$400/trip), lodging (@

\$100/night), and per diem (@ \$49/day). Conference registration fees are detailed under 'Other Direct Costs' in accordance with University of Arizona cost classification practices.

To support observations made with Supercam during observing campaigns, rental vehicle support for 14 days of on-site observations at the HHT is requested at \$40/day.

F. OTHER DIRECT COSTS

Funds are requested in each year for research supplies and work-flow/data capture and telecommunications expenses required for the conduction of this investigation. These operational items represent the material costs of creating, replicating, archiving, distributing and presenting all project related data, documentation, reporting, and analysis that are directly related to this project. Such material costs include external disk drives, poster printer costs, and analysis and presentation software.

Funds are requested in year 1 for new IF processor LO units, to allow both HCO+ J=4-3 and CO J=3-2 to be observed simultaneously, a requirement of this proposal effort.

Funds are requested for minor electronics repairs to the Supercam instrument. Costing is estimated from the replacement costs of repairs during Supercam's laboratory testing over the past two years, including replacement of instrument control computers, hard drives, solid state storage, power supplies, and cooling fans.

Funds are requested in year 1 for the refurbishment of Supercam's two closed-cycle refrigerators (Sumitomo and CTI-350 cold heads), which are a basic maintenance requirement. The costs listed are based on actual costs incurred over the last two years of Supercam testing in the laboratory.

Instrument transport and installation at the HHT is budgeted in year 1 to allow observations to begin as early as possible in the program. The \$2500 total estimate is based on the costs incurred in the previous two engineering runs at the telescope – including multiple rental vehicles, including a box truck for the transport of the instrument itself; rigging and lifting equipment, vacuum and electrical spares for support of those subsystems at the HHT, and other minor integration costs.

Funds are requested for one graduate student AAS conference registration per year.

Funds are requested for publication of findings in professional journals each year; estimated at 3 papers of 8 pages per year @ \$110/page (Astrophysical Journal).

G. INDIRECT COSTS

The university-mandated indirect cost rate of 51.5% was applied to all costs except capital equipment and 50.0% of the graduate student fringe benefit rate, which is for tuition remission and exempt from IDC.

*A cost inflation rate of 3.3% per year is applied to all eligible costs for years 2 and 3.