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STATUS OF THE CANARIAS INFRARED CAMERA EXPERIMENT (CIRCE)

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We report on the design status of the Canarias InfraRed Camera Experiment (CIRCE), a near-infrared visitor instrument for the Gran Telescopio Canarias (GTC). Besides functioning as a 1-2.5 μm imager, CIRCE will have the capacity for narrow band imaging, low and moderate resolution grism spectroscopy, and imaging polarimetry. Other design features include fully cryogenic filter, slit, and grism wheels, high-speed photometry modes, and broad-band imaging in J, H, and Ks filters. We anticipate that a myriad of scientific projects will benefit from CIRCE's unique combination of capabilities, which will also compliment the EMIR instrument. We will preview one such research project currently in progress: the search for and identification of very massive stars in our Galaxy.

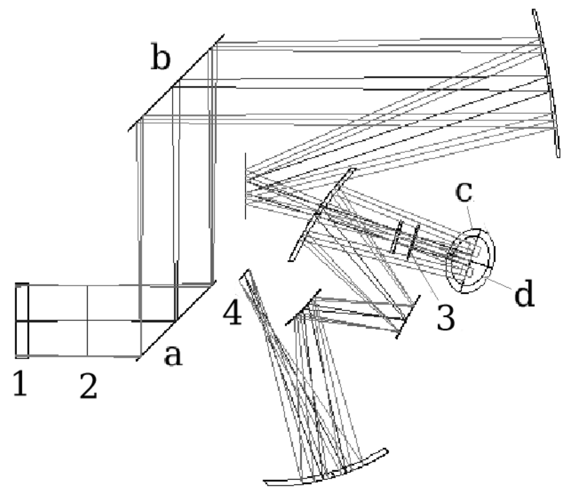

Fig. 1. The all-reflective aspheric optical design of CIRCE. Lettered optics (a-d) are fold mirrors recently added to conform CIRCE to the required envelope size. Numbered optics are: (1) entrance window, (2) telescope focal plane, (3) filter wheel, (4) detector focal plane.

Design Motivation and Progress

The 10.4-meter Gran Telescopio Canarias (GTC) is currently scheduled for first light in 2005. While two instruments, CanariCam (covering 5.0-28.0 μm) and OSIRIS (covering 0.4-1.0 μm) will be immediately available upon completion of the telescope, EMIR, the near-infrared facility instrument, is not scheduled for operation until late 2007. We designed the Canarias InfraRed Camera Experiment (CIRCE), a 1-2.5 μm imager, to observe the currently uncovered wavelength range and fill the gap between first and second generation instruments.

CIRCE has an all-reflective aspheric optical design that offers excellent throughput and image quality. We analyzed the 6 mirror optical layout, concentrating on characteristics such as spot size, enclosed energy, field-of-view, and pupil image. CIRCE's 3.4 $\times$ 3.4 arcminute field-of-view is 25 times larger than NIRC on Keck and 3 times larger than NIRI on Gemini. The enclosed energy analysis shows that in the J band, CIRCE will approach the diffraction limit in the center of the field. Even at the corners, one 9 micron pixel radius will contain >70% of the light from a point source. The $0.10''$ plate scale provides seeing limited images even in excellent atmospheric conditions; preliminary models suggest that it will produce images with < 0.25 arcsec intrinsic FWHM.

To conform the original configuration to the required envelope specifications, we added four fold mirrors. The current optical layout is shown in Figure 1. The design phase is now nearing the final stages of completion and a pre-fabrication review is planned.

Since the goal of CIRCE is to design, build, and integrate a powerful and useful instrument in a short amount of time, we must draw from the proffered expertise and skill of other GTC instrumentation teams. We will use cryo-mechanical designs from previous successful instruments at the University of Florida. This will make fabrication of filter, Lyot, and slit wheels very efficient. Also, both the MCE array controller and HAWAII-2 detector are currently at UF ready for use. Finally, the CIRCE team is

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working with the EMIR team to investigate the sharing of user interface software designed for EMIR.

Massive Stars: An Example of Science with CIRCE

There is a noticeable dearth of information about very massive stars in our Galaxy. The location of these objects in the Galactic Plane, an area subject to high extinction and overcrowding, has barred optical surveys from detecting 95% of very massive star clusters. Since massive stars dominate power output, CNO enrichment, and UV radiation in a host galaxy, information about these clusters is crucial. A more complete data set could answer questions about star formation histories and the origin and evolution of compact objects.

More intriguing data about massive stars continues to surface. The discovery of the Pistol Star, with a mass greater than $150 M_{\odot}$ (Figer et al. 1998), and LBV 1806-20 (Eikenberry et al. 2004), with a potential mass $> 200 M_{\odot}$, indicate that the maximum stellar mass may exceed previous estimates. Further examples of very massive stars would support current data and continue to forward our understanding of these phenomena.

CIRCE will provide a unique opportunity to search for massive star clusters in our Galaxy. Using narrow-band filters, we will probe for lines indicative of massive stellar atmospheres. These include: Brγ, Paβ, He I, He II, and Fe II. Then, using CIRCE in low-resolution spectroscopy mode, we will follow up these observations to confirm any high mass star candidates.

REFERENCES

Eikenberry, S. S., et al. 2004, ApJ, in press
Figer, D. F., et al. 1998, ApJ, 506, 384