

The Far Infrared Spectroscopic Explorer: probing the lifecycle of the ISM in the Universe

Dimitra Rigopoulou^{*}, Brian Ellison², M. Caldwell², G. Yassin¹, M. Wiedner³, V. Ossenkopf-Okada⁴ and the FIRSPEX Consortium

¹University of Oxford, OX1 3RH, Oxford, UK

²RAL Space, STFC, OX11 0QX, Didcot, UK

³LERMA, Observatoire de Paris, F74014, France

⁴I. Physikalisches Institut, Universität zu Köln, 50937, Köln, Germany

^{*}Contact: dimitra.rigopoulou@physics.ox.ac.uk

Abstract— The Far Infrared Spectroscopic Explorer (FIRSPEX) is a novel European-led astronomy mission concept developed to enable large area ultra high spectroscopic resolution surveys in the THz regime. FIRSPEX opens up a relatively unexplored spectral and spatial parameter space that will produce an enormously significant scientific legacy by focusing on the properties of the multi-phase ISM, the assembly of molecular clouds in our Galaxy and the onset of star formation; topics which are fundamental to our understanding of galaxy evolution. The mission uses a heterodyne instrument and a ~1.2 m primary antenna to scan large areas of the sky in a number of discrete spectroscopic channels from L2. The FIRSPEX bands centered at [CI] 809 GHz, [NII]1460 GHz, [CII]1900 GHz and [OI]4700 GHz have been carefully selected to target key atomic and ionic fine structure transitions difficult or impossible to access from the ground but fundamental to the study of the multi-phase ISM in the Universe. The need for state-of-the-art sensitivity dictates the use of superconducting mixers configured either as tunnel junctions or hot electron bolometers. This technology requires cooling to low temperatures, approaching 4K, in order to operate. The receivers will operate in double sideband configuration providing a total of 7 pixels on the sky. FIRSPEX will operate from L2 in both survey and pointed mode enabling velocity resolved spectroscopy of large areas of sky as well as targeted observations. FIRSPEX has been submitted in response to ESA's M5 call for proposals and is currently under review.