A flexible quasioptical input systen for a submillimter multi-object spectrometer

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Abstract

We present a conceptual design for the input optical system for a multi-object spectrometer operating at submillimeter wavelengths, which is well suited for use on the Cornell Caltech Atacama Telescope (CCAT) or any other large single-dish telescope having a large field of view. The âĂIJMirror MOSâĂİ is based on a sequence of mirrors that enable low-loss propagation of beams from selected positions distributed throughout the focal plane to the spectroscopic receiver inputs. Unlike the majority of millimeter and submillimeter focal plane arrays built to date, the key requirement for a multi-object spectrometer is not to get full sampling of a region of the sky, but to be able to observe selected sources that are sparsely distributed over the relatively large area imaged to the focal plane. The approach we describe here should be useful for observations of distant galaxies which have a relatively low density on the sky, but which are very weak so that simultaneous observation of many sources results in a significant improvement in telescope productivity. It is assumed that the candidate sources have been previously identified, so that their coordinates are known. Our concept is based on assigning a patrol region to each of the receivers, which have inputs distributed over the focal plane of the telescope. The input to each receiver can be positioned at any point within this patrol region. This approach, with only 4 reflections, offers very low loss. In many cases, a set of flat mirrors can be used, but employing focusing optics can make the system more compact. A further advantage of using beam transformation is that a Gaussian beam optical system can be designed to produce frequency-independent illumination of the telescope, which is an important advantage for very broadband systems such those required for determination of redshifts of submillimeter galaxies. We have made calculations of the expected efficiency of such a Mirror MOS system with a range of patrol region parameters, receiver number, and source density, and find that ~ 80 percent utilization can be expected for redshift determination from CO lines and reasonable estimates of submillimeter galaxies observed with a 25 m telescope observing in the 1mm atmospheric window.