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THE GOULD'S BELT DISTANCE SURVEY

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RESUMEN

Observaciones que utilizan la interferometría de muy larga línea de base (VLBI por sus siglas en inglés) pueden proveer la posición de radiofuentes compactas con una precisión del orden de 50 micro-segundos de arco. Esto es suficiente para medir la paralaje trigonométrica y los movimientos propios de cualquier objeto localizado hasta 500 pc del Sol con una precisión mejor que unos porcientos. Por ser magnéticamente activas, las estrellas jóvenes a menudo emiten emisión radio compacta detectable usando técnicas VLBI. Aquí, mostraremos cómo observaciones VLBI ya han restringido la distancia a las regiones de formación estelar cercanas más frecuentemente estudiadas (Tauro, Ofiuco, Orión, etc.) y han empezado a revelar su estructura y su cinemática interna. Luego, describiremos un gran proyecto (llamado *The Gould's Belt Distance Survey*) diseñado para proveer una vista detallada de la formación estelar en la vecindad Solar, usando observaciones VLBI.

ABSTRACT

Very Long Baseline Interferometry (VLBI) observations can provide the position of compact radio sources with an accuracy of order 50 micro-arcseconds. This is sufficient to measure the trigonometric parallax and proper motions of any object within 500 pc of the Sun to better than a few percent. Because they are magnetically active, young stars are often associated with compact radio emission detectable using VLBI techniques. Here we will show how VLBI observations have already constrained the distance to the most often studied nearby regions of star-formation (Taurus, Ophiuchus, Orion, etc.) and have started to provide information on their internal structure and kinematics. We will then briefly describe a large project (called *The Gould's Belt Distance Survey*) designed to provide a detailed view of star-formation in the Solar neighborhood using VLBI observations.

Key Words: astrometry — radiation mechanisms: non–thermal — radio continuum: stars — stars: pre-main sequence — techniques: interferometric

1. INTRODUCTION

An recurrent obstacle in the study of star-formation has been the fairly large uncertainties (typically 20 to 50%) affecting the distances to even the nearest sites of active star-formation. Such large errors imply even larger uncertainties on the derived parameters (such as the luminosity, mass or age) of the young stellar objects under study, and limit our ability to compare theoretical predictions with observational results.

Trigonometric parallax measurements provide the only direct way of gauging distances to objects outside of the Solar system, but they are difficult to obtain even in the Solar neighborhood. For an object at 500 pc, for instance, the trigonometric parallax is only 2 milli-arcseconds (mas). To obtain a parallax measurement accurate to 2% in this case would require astrometric observations accurate to about 40 μas. Even expensive space missions dedicated to astrometry (such as Hipparcos; Perryman et al. 1997) did not reach such a level of accuracy.

Very Long Baseline Interferometry (VLBI; e.g. Thompson, Moran, & Swenson 2001) is an observing technique that can readily provide astrometric accuracies of order 50 μas, for compact radio sources of sufficient brightness ($T_b \approx 10^7$ K). Such sources exist in all star-forming regions, because low-mass young stars are often magnetically active. The gyration of relativistic electrons in the strong magnetic fields surrounding low-mass young stars produce radio emission detectable with VLBI instruments (Dulk 1985). This emission is normally confined to regions extending only a few stellar radii around the stars, and therefore remain very compact even in the nearest star-forming regions (at

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