Astronomy in Focus, Volume 1, Focus Meeting 8
XXIXth IAU General Assembly, August 2015
Piero Benvenuti, ed.

doi:10.1017/S1743921316002878

Astrometric exoplanet surveys in practice

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Abstract. Conversely to the transit photometry and radial velocity methods, the astrometric discovery of exoplanets is still limited by the sensitivity of available instruments. Ground-based surveys are now sensitive to giant planets in orbit around nearby low-mass stars and brown dwarfs. In 2014, ESA's Gaia mission began its survey, which is expected to discover thousands of giant exoplanets by detecting the astrometric orbital motions of the host stars.

Keywords. Astrometry, planetary systems, binaries, telescopes, space vehicles

1. Introduction

In comparison to other observational techniques, the contributions of astrometry to the discovery of exoplanets have so far been limited (Fischer *et al.* 2014). However, promising results were obtained with past (Muterspaugh *et al.* 2010) and ongoing surveys.

2. Ongoing surveys

Most present-day observational programs employ optical/infrared cameras on intermediate and large telescopes (e.g. Boss *et al.* 2009; Lurie *et al.* 2014; Sahlmann *et al.* 2014). Typical targets are low-mass stars and brown dwarf within tens of parsec of the Sun and the planet detection sensitivities reach Jupiter-mass for year-long periods (e.g. Weinberger *et al.* 2014; Sahlmann & Lazorenko 2015).

3. Gaia

The combination of our current knowledge of giant planet occurrence with the astrometric precision, sampling, and 5-year duration of the all-sky Gaia mission (de Bruijne 2012) translates into a number of expected exoplanet discoveries in excess of several thousand (Casertano *et al.* 2008; Sozzetti *et al.* 2014; Perryman *et al.* 2014; Sahlmann *et al.* 2015). This major step in instrumental capabilities will have to be matched by improved algorithms that optimally exploit the data. Using very precise ground-based astrometry we employed genetic and MCMC algorithms and proved them to be efficient in constraining all astrometric parameters of a low-mass binary system (Sahlmann *et al.* 2013). Similar algorithms will be applied to some of the Gaia exoplanet data (cf. Sozzetti 2013), which makes them important tools for harvesting the results of the first major astrometric exoplanet survey.

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