Constraining the pitch angle of the galactic spiral arms in the Milky Way

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Abstract.

We carry out analyses of some parameters of the galactic spiral arms, in the currently available samples.

We present a catalog of the observed pitch angle for each spiral arm in the Milky Way disk. For each long spiral arm in the Milky Way, we investigate for each individual arm its pitch angle, as measured through different methods (parallaxes, twin-tangent arm, kinematical, etc), and assess their answers.

Second, we catalog recent advances in the cartography of the Galaxy (global mean arm pitch, arm number, arm shape, interarm distance at the Sun). We statistically compare the results over a long time frame, from 1980 to 2017. Histograms of about 90 individual results published in recent years (since mid-2015) are compared to 66 earlier results (from 1980 to 2005), showing the ratio of primary to secondary peaks to have increased by almost a factor of 3. Similarly, many earlier discrepancies (expressed in r.m.s.) have been reduced by almost a factor 3.

1. Introduction

In this contribution, we present exploratory analyses of galactic spiral arms properties, notably the pitch angle, with the aim of constraining their individual and global values, as best could be done with currently available samples.

Our knowledge of the main parameters of the spiral arms (their number, their shape, their pitch angle, and the interarm separation through the Sun between the Sagittarius and the Perseus arms) has evolved with time, but some discrepancies have lingered on.

An early picture of the location of each spiral arm is that in Courtès et al (1969 – their fig. 6 and Table 2), with 4 arms, a pitch angle of -20^{o}, an interarm separation of about 4kpc, and a approximate log shape (disregarding the local Orion armlet), using 10 kpc for the distance from the Sun to the Galactic Center. A very recent model picture can be seen in Fig. 2 of Vallée (2016a), with 4 arms, a