

Observatory (University of Victoria) and the Dominion Astrophysical Observatory. The effectiveness of this programme is due to a combination of the application of state-of-the-art digital image processing techniques with exceptionally efficient orbit and ephemeris generation software, developed by the authors, that enables real-time tracking of any solar-system object brighter than magnitude 22. This paper concentrates upon 41 recently monitored near-Earth asteroids and describes the orbital evolution and future encounter circumstances of some interesting individuals.

Do Large-Scale Density-Velocity Correlations Test Gravity?, A. Babul, Canadian Institute for Theoretical Astrophysics, D.H. Weinberg, Institute for Advanced Study, A. Dekel, Racah, J.P. Ostriker, Princeton University.

We challenge a widely accepted assumption of observational cosmology: that successful reconstruction of observed galaxy density fields from measured galaxy velocity fields (or *vice versa*), using the methods of gravitational instability theory, *proves* that the observed large-scale structures and large-scale flows were produced by the action of gravity. This assumption is false, in that there exist non-gravitational theories that pass the reconstruction tests and gravitational theories with certain forms of biased galaxy formation that fail them. Gravitational instability theory predicts specific correlations between large-scale velocity and density fields, but the same correlations arise in any model where (a) structures in the galaxy distribution grow from homogeneous initial conditions in a way that satisfies the continuity equation, and (b) the present-day velocity field is irrotational and proportional to the time-averaged velocity field. We demonstrate these assertions using both analytical and numerical arguments, based on linear perturbation theory and on cosmological N -body simulations of specific gravitational and non-gravitational models.

If large-scale structure formed by gravitational instability, then the ratio of the galaxy density contrast to the divergence of the velocity field yields an estimate of the density parameter Ω (or, more generally, an estimate of $\beta = \Omega^{0.6}/b$, where b is an assumed constant of proportionality between galaxy and mass density fluctuations). In non-gravitational scenarios, the values of Ω or β estimated in this way may not represent the true cosmological values. However, even if non-gravitational forces initiate and shape the growth of structure, gravitationally induced accelerations can dominate the velocity field at late times, long after the action of any non-gravitational impulses. The estimated β approaches the true value in such cases, and in our numerical simulations the estimated β values are reasonably accurate for both gravitational and non-gravitational models.

Reconstruction tests that show the existence of correlations between galaxy density and velocity fields can rule out some physically interesting models of large-scale structure. In particular, successful reconstructions constrain the nature of any bias between the galaxy and mass distributions, since processes that modulate the efficiency of galaxy formation on large scales in a way that violates the continuity equation also produce a mismatch between the observed galaxy density and the density inferred from the peculiar velocity field. The reconstruction methods do not test the gravitational instability hypothesis *per se*, but they can test hypotheses about the physical processes that influence the formation of galaxies and large-scale structure.

Photometry of Recently-Discovered Extragalactic Supernovae, D.D. Balam, D.R. Zurek, F.D.A. Hartwick, R.M. Robb, University of Victoria, G.C.L. Aikman, Dominion Astrophysical Observatory.

The joint UVic/DAO programme for photometric monitoring of extragalactic supernovae is described. During the past year we have obtained photometric observations of 18 supernovae ranging in apparent brightness from magnitude 10 to 21. Real-time reduction of high-precision astrometric positions has become routine and precise positions are supplied, when applicable, to the international astronomical community. A number of processing techniques have been developed to account for

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host galaxy contamination, which has now been reduced to the five per cent level. Future developments in this area will allow us to reduce contamination even further.

The Algonquin Radio Observatory: Development of Astronomical Projects, N. Bartel, Department of Physics and Astronomy, York University, W.H. Cannon, Institute of Space and Terrestrial Science.

The 46m radio antenna at the site of the Algonquin Radio Observatory has three characteristics that are useful for dedicated astronomical and astrometric projects: sensitivity, availability of ample observing time, and location in an almost radio-interference free environment.

The antenna participated in sensitive, global VLBI (Very Long Baseline Interferometry) observations of SN1993J in M81 to help to produce a sequence of images of an exploded star. We have also used the antenna as the largest and most sensitive element of a VLBI array for repeated observations of several radio pulsars. These observations will determine the pulsar's parallax distances with up to five per cent accuracy and help to improve the dispersion based galactic distance scale.

We will discuss these and other projects planned for the future; in all cases the 46m antenna plays an important role.

The Circumstellar Environment of V376 Cas and V633 Cas: How Many Stars Are There?, P. Bastien, Université de Montréal, F. Ménard, Observatoire de Grenoble, L. Asselin, Université de Montréal.

We present optical direct and polarimetric imaging and aperture polarimetry for the Herbig Ae/Be stars V633 Cas (LkH α 198) and V376 Cas. Although V376 Cas is located about 37'' north of V633 Cas, both stars are connected together by circumstellar material.

V633 Cas has a circular structure on a small scale and is associated with a large scale optical outflow oriented NW-SE with a mean position angle of about 128° and a mean eccentricity of about 0.83. We observe a rotation of the elongated contours with increasing contour size. This large scale bubble corresponds to a redshifted carbon monoxide outflow. Various condensations are present within the circumstellar material of V633 Cas. The blueshifted emission knot east of V633 Cas is seen in [S II], well aligned with the star. Also the infrared object IRAS 00087+5833 is seen in both *R* and [S II] images. The position of V633 Cas does not change with wavelength within the uncertainties. We suppose its linear polarization to be time-variable. A pattern of aligned vectors is at present close to V633 Cas in our polarization maps. It is produced by an accretion disk inclined at about 60° to our line of sight and with its near edge to the west, so that the blueshifted knot east of V633 Cas is well explained as originating from the star. Hence V633 Cas cannot be the source of the large scale outflow. We suggest the infrared object IRAS 00087 + 5833, which lies on the major axis of the molecular outflows, is the most probable candidate for the source of the outflow.

High-resolution images with very good seeing in *R* and [S II] filters reveal the presence, for the first time, of two peaks about 1'' apart at the optical position of V376 Cas. The optical position of V376 Cas varies with wavelength. The relative position offsets in different bandpasses are located on a line which makes a position angle of 240° and is not perpendicular to the line joining the two peaks. V376 Cas has the largest linear polarization observed so far in a young stellar object, about 23 per cent at a position angle of about 25°. This is explained with multiple scattering and a high extinction in front of the star. Polarization maps of V376 Cas show a pattern of aligned vectors near the star and two null points. This is also compatible with high polarization and the presence of a disk. We discuss two possible interpretations: (1) a double star with a 1'' separation, each one being associated with an outflow, and (2) a single star with an edge-on disk such that we see two cones of light escaping on each side of the disk. We tend to favour the second interpretation because of the polarization pattern.