of the Universe since the Big Bang. Yet because gravitating matter and a positive cosmological constant pull and push the expansion of the Universe in opposite ways, the data from SNe Ia alone still allow for many combinations of Ω_m and Ω_Λ.

Another approach derives a constraint on a different mix of the cosmological parameters by quantifying the degree to which local mass in different parts of the Universe tugs on nearby galaxies. Although most of the apparent motion of galaxies results from the expansion of the Universe, some excess or 'peculiar' velocity arises from the gravitational pull of nearby mass concentrations[10]. Zehavi and Dekel[1] obtained limits on Ω_m of the Universe by using observations of these peculiar velocities. These measurements favour $\Omega_m \ll 1$, which is a notable result from researchers who once provided the strongest evidence in support of a Universe flattened by mass (that is, $\Omega_m = 1$)[11].

The area of parameter space highlighted by combining these peculiar velocity results with the supernova results is seductively close to the theoretical preference for a geometrically flat Universe. Yet, the danger of blindly combining (and trusting) the results of different measurements is to lose sight of the systematic uncertainties involved in individual techniques. For the peculiar velocity methods, if one or more assumptions are not valid (for example, that the initial mass fluctuations are normally distributed) then the implications may not be correct. Similar challenges face the conclusions drawn from supernovae data, such as the possibility of supernova evolution[12,13] or exotic intergalactic dust, which could scatter light from supernovae making them appear further away than they are[14].

By pushing the observations of supernovae to greater distances (and therefore further back in time) it should be possible to conclusively confirm or refute the initial indications that we are living in an accelerating Universe. We expect a younger, smaller Universe to be denser and to experience greater deceleration from gravity, so the apparent brightness of supernovae should decrease more slowly with distance than is likely to occur under the influence of systematic effects.

Finally, measurements of tiny ripples in the radiation left over from the hot Big Bang — the cosmic microwave background — are beginning to point towards a Universe which is geometrically flat. These first hints will soon be surpassed by data from the MAP and Planck satellites due early next year. By combining enough independent constraints it should be possible to arrive at a set of cosmological parameters that is not vulnerable to systematic uncertainties in any single measurement. Although some cosmologists have voiced concern that the recent studies imply that we live at a special time — that is, shortly after the transition from a decelerating to an accelerating Universe — can there be any time more special than when we first begin to learn the answers to our Universal questions? ■

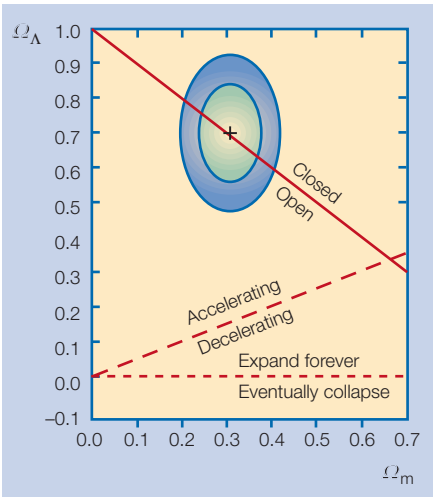

Figure 1 **Window on the Universe. To discover the values of the parameters Ω_m (mass density) and Ω_Λ (cosmological constant) that define the evolution of the Universe, cosmologists overlay data from different astrophysical techniques to create a window in the allowed parameter space. Zehavi and Dekel[1] have combined data from studies of supernova and peculiar velocities to strengthen the case for a positive cosmological constant. The results of a similar study[15] using nine independent astrophysical measures are shown here. The cross marks their best guess, where $\Omega_m = 0.3$ and $\Omega_\Lambda = 0.7$, and the contours represent relative confidence limits of 68% and 98%. The solid line corresponds to a flat Universe ($\Omega_m + \Omega_\Lambda = 1$), separating an open Universe from a closed one. The dotted line ($\Omega_\Lambda = 0$) separates a Universe that will expand forever from one that will eventually collapse in the Big Crunch, whereas the dashed line separates a Universe with an expansion rate that is decelerating from one that is accelerating.**

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100 YEARS AGO

One result of the rapid growth of seismology is the suggestion of Dr. Mario Baratta that provision should be made by insurance against the damage to buildings caused by earthquakes in certain countries. He shows that, since the beginning of the seventeenth century, less than forty earthquakes have been responsible for deaths of more than 150,000 persons in Italy alone. Moreover, to take but one example, the great loss of life during the Ischian earthquake of 1883 was due to the fact that the buildings had already been damaged by the earthquakes of 1828 and 1881. Dr. Baratta points out some of the conditions that must determine the amount of the premium that should be demanded by insurance societies. The most important is the degree of seismicity of the district; but this would be modified by others, such as the nature of the surface-rocks, the character of the buildings, &c. One advantage of compulsory insurance against earthquakes in a country like Italy would be that partially damaged buildings would be at once rebuilt or repaired, and this would tend to diminish the loss of life in the future.

From *Nature* 14 September 1899.

50 YEARS AGO

Social Biology and Welfare
By Sybil Neville-Rolfe…

In 1905, at the age of twenty, the widow of a naval officer announced to her relatives her intention "to study prostitution and venereal disease and try to get rid of them". She knew of no organisation or senior friend under whose tutelage she could begin. With courage and energy, Mrs. Neville-Rolfe plunged into the obscurity and obscurantism surrounding the problems of sex irregularity; learning the hard way, but backed by the irrepressible gifts of her personality, she has given the last forty-five years to by no means unsuccessful efforts to induce the public and officials, both at home and abroad, to face squarely and openly some of the biological and social factors involved in healthy and unhealthy sex and family relationships in the community. … Unfortunately, the book itself is not a useful contribution to the campaign for a rational, humane and continuously constructive approach to the problems of social hygiene, the complexities of which grow the more we know about the field. … Mrs Neville-Rolfe's gifts are more those of a crusader than of a writer.

From *Nature* 17 September 1949.