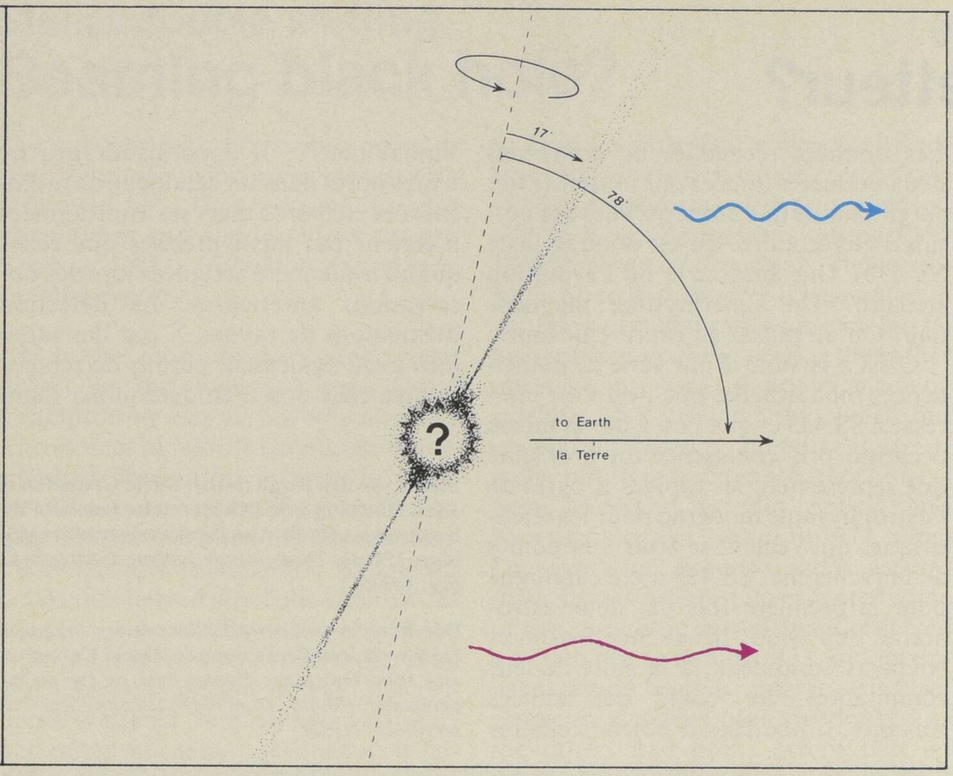

The answer to the perplexing data is portrayed in this diagram of the object. The small dense companion of the SS433 system emits two streams of material at very high velocity. As the poles of the body precess, the jets swing toward and away from observers on earth. High speed particles emit signals strong enough to give the appearance of the whole system being in motion. *(Graphic: John Bianchi)*

L'explication de ces données intriguantes se trouve dans ce diagramme de l'objet. Le petit compagnon dense du système SS 433 émet deux jets de matière animés d'une très grande vitesse. Lorsque les pôles du corps amorcent un mouvement de précession, ces jets se rapprochent et s'éloignent tour à tour des observateurs terrestres. Les particules atteignant une haute vélocité émettent des signaux suffisamment puissants pour qu'on ait l'impression que l'ensemble du système est en mouvement. *(Illustration: John Bianchi)*

Astronomers consider the spectral lines in starlight to be the star's "fingerprints". These lines tell a great deal about the star's make-up, indicating which elements are present and what chemical and physical changes are taking place. From the location of these lines scientists can determine whether a star is hot or relatively cool, whether its atmosphere is clear or if the star is surrounded by cool dust clouds and, most significantly for SS433, if it is in motion. When these lines are "shifted" in a stellar spectrum from the positions they are found in the laboratory, it indicates the star is in motion. If it is moving away from us the lines are shifted toward the red end of the light spectrum, if toward us to the blue end of the spectrum. The further the shift toward the edges, the greater the velocity of the star.

Bruce Margon and his associates studied the light from SS433 and found not only one of the largest redshifts yet observed for an object in our galaxy, but they also found, simultaneously, a record blueshift. The spectrum indicated the object was moving away from us at 50 000 km per second and toward us at 30 000 km per second. More incredible, they found that the lines galloped further apart as the nights passed, reached an extremity, turned and began to move back toward certain stationary lines in the centre of the spectrum, which they crossed and hastened out to the extremes again. To add to the mystery, these variations were observed to be periodic, repeating every 164 days.

Unwilling to accept such a blatant violation of known physical laws, astronomers around the world began an intense investigation of SS433. Inordinate amounts of telescope time were given over to verifying the original data. Radio and optical telescopes were put to work, along with satellites which measure the X-ray frequencies not detectable from the earth's surface.

Evidence concerning SS433 came next from Canada where NRC's Dr. Sidney van den Bergh photographed an expanding gas cloud known as W 50, which looked increasingly like a supernova remnant. Van den Berg, known for his work on these violent stellar explosions, located the cloud with much greater precision and showed that SS433 was smack in the centre of the remnant. Some astronomers had suggested that W 50 was outside our galaxy, but the NRC study moved it closer to home, well within the Milky Way at a distance of about 10 000 light years. Van den Bergh also calculated the nebula's dimensions and found it to be the largest supernova remnant yet recorded. This added some fresh surprise in view of W 50's apparent youth — only 10 000 years old.

Meanwhile, Victoria's David Crampton and John Hutchings were taking another look at the object. The spectra from Margon's California studies indicated that in addition to the moving lines there was a set of lines which remained at rest, the so-called "stationary lines". Using the 1.8 m telescope at Victoria, they studied the "stationary" features of SS433's spectrum. "Instruments on the Dominion Observatory's telescopes are particularly well suited to this type of measurement," Crampton says. "We are able to pinpoint small shifts in objects of low luminosity. In the case of SS433, not only is the luminosity low, it is erratic. These conditions have made observations difficult and the resulting theories questionable."

At first glance, Crampton's work seemed to add to the growing puzzle surrounding SS433. His results indicated a new variation, a 13.1-day shift in the until then stationary spectral lines of SS433's light. Astronomers, however, actually welcomed this find as bringing some order to the accumulating chaos of information. The 13-day variation pointed to SS433 being a binary system. Such a picture fits the classical model of a supernova remnant — a spreading cloud of gas moving away from a core containing what is left of the stellar material, in this case a binary star. It also set the stage for the formulation of a theoretical model of SS433 now accepted by most astronomers.

SS433 is indeed a binary star, but one in which a normal star is paired with a dark companion, perhaps a neutron star or that ultimate expression of gravitational collapse, a black hole. These two neighbors orbit one another every 13 days, with matter from the normal star all the while being stripped away, spiralling down into its invisible neighbor and forming what is known as an "accretion disc".