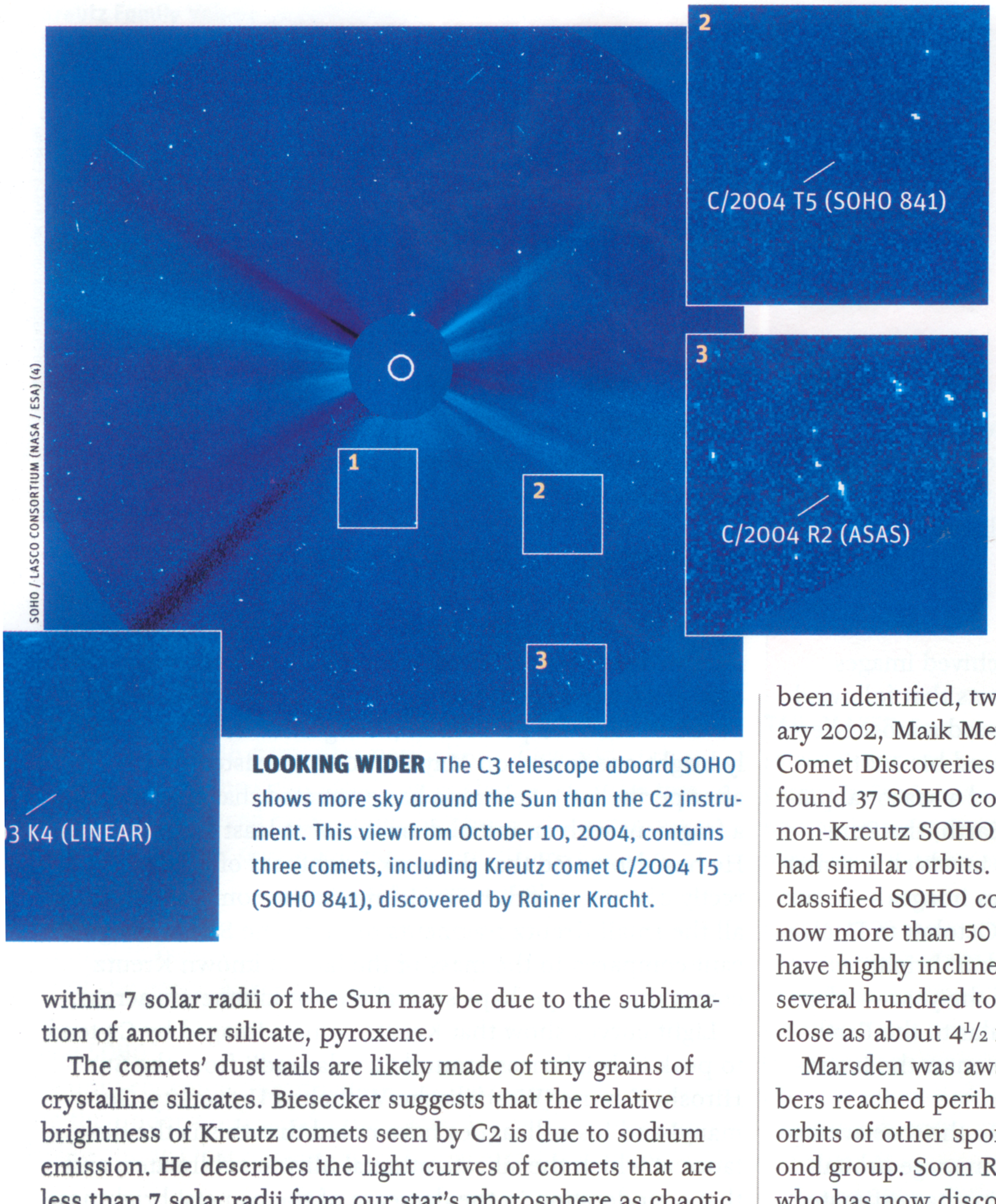

LOOKING WIDER The C3 telescope aboard SOHO shows more sky around the Sun than the C2 instrument. This view from October 10, 2004, contains three comets, including Kreutz comet C/2004 T5 (SOHO 841), discovered by Rainer Kracht.

within 7 solar radii of the Sun may be due to the sublimation of another silicate, pyroxene.

The comets' dust tails are likely made of tiny grains of crystalline silicates. Biesecker suggests that the relative brightness of Kreutz comets seen by C2 is due to sodium emission. He describes the light curves of comets that are less than 7 solar radii from our star's photosphere as chaotic. Sekanina attributes this behavior to the existence of large but unresolved fragments with relatively low erosion rates.

Many Kreutz pairs, triplets, and at least one quadruple comet have been seen on SOHO images, their components appearing within hours of each other and traveling on slightly different trajectories. Sekanina, who has studied how Comet Shoemaker-Levy 9 and others have split apart, has concluded that the events that create these multiple nuclei often occur far from the Sun, even around aphelion. He sees the evolution of the Kreutz group as a cascading series of fragmentations in which a comet must have split several times during the course of a single revolution around the Sun into progressively smaller pieces.

So far, only one comet discovered in LASCO images has become visible to other ground-based observers. In May 1998 a "sporadic" (non-group) comet appeared bright and with a tail in C3 images. Within a couple of weeks, C/1998 J1 (SOHO 49)* became well placed for Southern Hemisphere observers and shone at 4th magnitude — but they had trouble locating it at first. SOHO's early astrometry was primitive; astronomers derived coordinates by measuring position angles and distances from the Sun. C/1998 J1's track along the edge of the C3 field — where distortion is greatest — was problematic. The situation inspired a crash effort to improve the astrometry, and Marsden reworked the older orbits. SOHO-based astrometry now is much more reliable.

New Groups, New Insights

Prior to SOHO, the Kreutz group (with some 80 percent of its members belonging to Subgroup I) was the only known comet group. Three new groups of near-Sun comets have since been identified, two of them by German amateurs. In January 2002, Maik Meyer — who manages the Catalogue of Comet Discoveries Web site (www.comethunter.de) and has found 37 SOHO comets — noted that a newly discovered non-Kreutz SOHO comet and one found four years earlier had similar orbits. He recalculated the orbits of other unclassified SOHO comets and found four more. There are now more than 50 known objects in the Meyer group. They have highly inclined orbits (about 71°), likely have periods several hundred to thousands of years long, and get as close as about 4½ million km to the Sun.

Marsden was aware of another related pair, whose members reached perihelion 4½ months apart. He reworked the orbits of other sporadic SOHO comets and identified a second group. Soon Rainer Kracht, a German schoolteacher who has now discovered more than 150 comets, including SOHO's 900th (May issue, page 112), identified a third group. The Kracht and Marsden groups are related, having a similar perihelion direction and distances (about 6½ million km); they each have about 20 known members. New-group comets are relatively inactive — nearly all appear stellar, tailless, and faint. Unlike Kreutz comets, many survive perihelion. They seem to be as prone to fragmentation as Kreutz comets, however. Marsden and Kracht comets have often come in pairs or even clusters. (In a three-day period in May 2004, no fewer than six Kracht comets — a quarter of all known members of the group — were detected.)

Marsden-group orbits nearly intersect Earth's. Comet 1999 J6 (SOHO 109) passed within 4 million km of our world in June 1999, a month after its perihelion. Unsettlingly, however, it remained undiscovered until Oates found it in the image archive in March 2000.

C/1999 J6 has another distinction. Marsden has concluded that C/2004 V9 (SOHO 859), found last November, is probably the same object as C/1999 J6, which would give it a period of 5.49 years. (If so, it would have passed just 1.3 million km from Earth on June 12, 1999, potentially the closest known cometary approach.) He also showed it likely that another Marsden comet, C/2005 E4 (SOHO 915), was the return of C/1999 N5 (SOHO 408) — with a period of

** Cometary designations approved by the International Astronomical Union use the form "C/1998 H2," which indicates the year and the half-month of first sighting — in this example, the second comet seen during the eighth two-week period (late April) of 1998. SOHO comets are also popularly numbered sequentially from discovery; C/1998 H2 is SOHO 48.*