Introduction: The Roman Space Telescope Coronagraph Instrument

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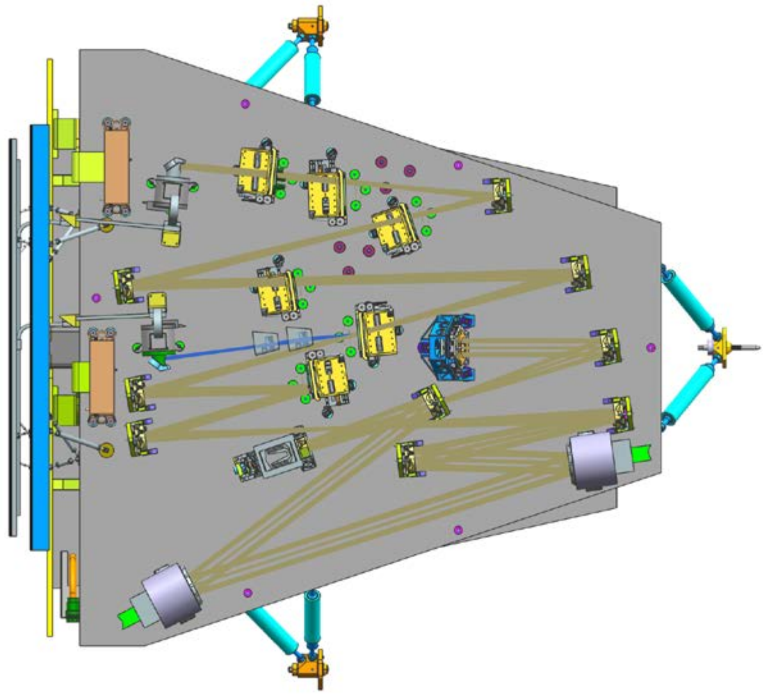
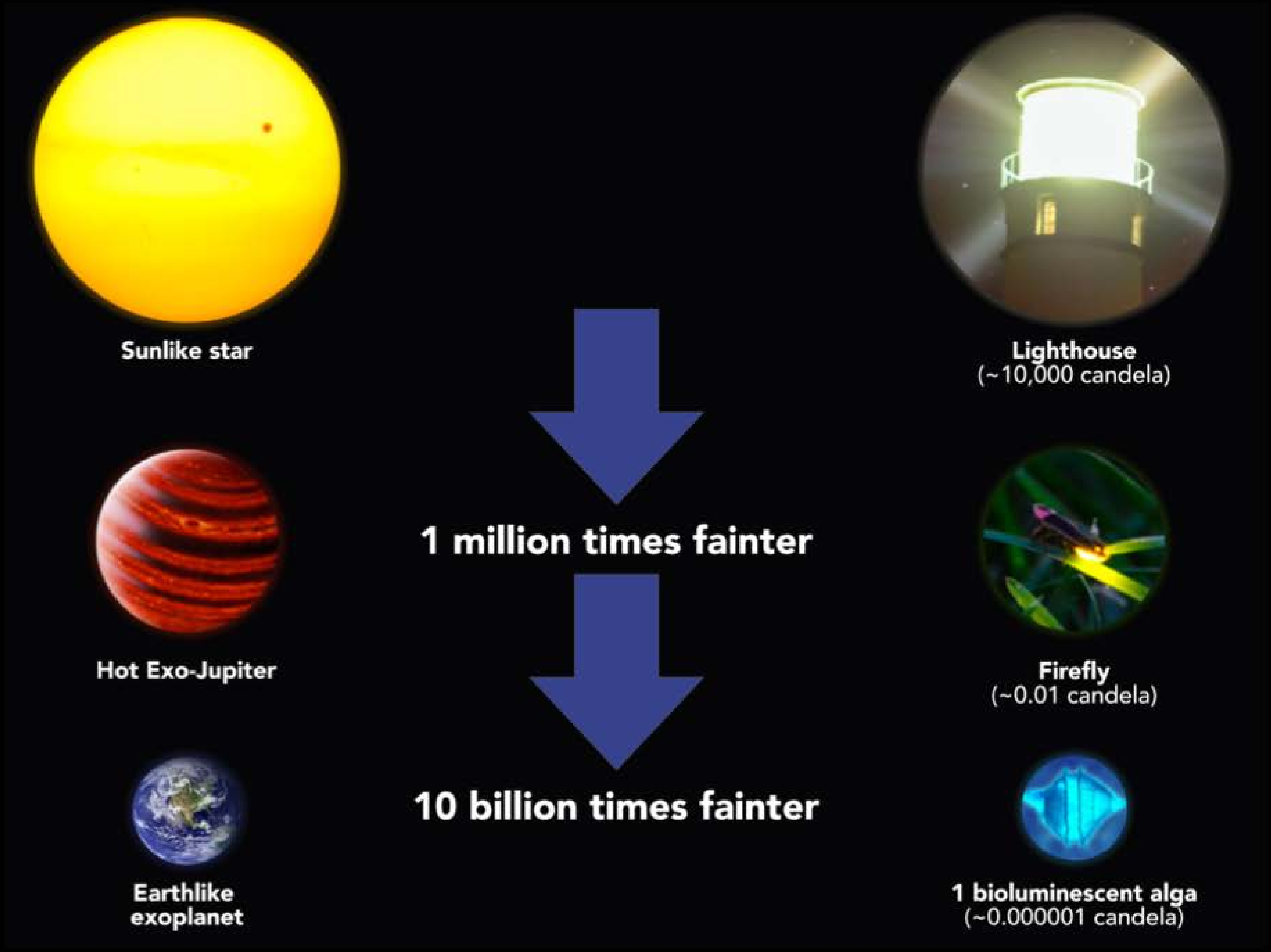


THE PROBLEM:

Seeing The Planet Through the Glare of Its Host Star



Adapted from a graphic by Kate Follette

Roman (1959)

First paper to suggest using a space telescope to directly image exoplanets

Popper, Daniel M. *The strange case of RS Canum Venaticorum.*

New spectrographic observations of the eclipsing binary, RS CVn show that the radii are 8 per cent and the masses 22 per cent smaller than previous evaluations. The K type subgiant is slightly more massive than the smaller F type star and does not appear to fill the critical zero-velocity surface. In these respects this system differs from most of those of similar kind.

The light curve has long been known to show persistent, but not constant, asymmetries, both within and outside of eclipse. Comparison of photoelectric observations made in 1956 and in 1959 shows the light of the K star at primary minimum to have increased by 0.3 mag. with no or only a slight change of color. There was no corresponding increase in the light outside of minimum. The light of the K star apparently varies intrinsically both with time and over its surface. The asymmetry outside of minimum is found by color measurements also to be caused by the K subgiant. This persistent asymmetry could be caused by a slight pulsation with the same period as the orbital motion. This system also undergoes changes of period of a unique character. Nearly continuous photometric observations of high precision are needed to determine the behavior of the star.

The spectrograms outside of eclipse show no evident peculiarities except for variable $H\alpha$ emission associated with the K star. The lines of the F star are sharp, hence the designation "n" of Joy's classification is not suitable.

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Rabe, Eugene. *The orbit of (1011) Laodamia and the mass of Mars.*

The recently improved orbit of the minor planet (1011) Laodamia (Rabe 1956) reveals a remarkable relationship to the orbit of Mars. The trajectories interlock near to the ascending node of Laodamia on Mars, and to the aphelion of Mars. The orbits approach to 0.04 a.u., yet the approach is so asymptotic that the distance between the two curves is of the order of 0.1 a.u. for orbital arcs of nearly 90°, between the approximate heliocentric longitudes of 96° and 181°. The orbits deviate by less than 0.05 a.u. between the longitudes 158° and 169°. The closeness of actual approaches depends on the difference of the longitudes. In consequence of the near commensurability of the mean motions of Mars and Laodamia in the ratio 1.97:1, any close approaches occur in series of successive passages. The subsequent approaches of September 1957 and March 1961 amount to 0.10 a.u. each. They are preceded by an approach to 0.36 a.u. in January 1954, and followed by approaches to 0.14 and 0.36 a.u. in September 1964 and June 1968, respectively.

If the Mars perturbations of Laodamia are integrated from a zero epoch in 1959, between the two closest approaches to 0.10 a.u., then in the backward integration the longitude perturbations exceed −1000″ already in 1941 (the discovery opposition is 1924). The perturbations will increase even more rapidly in the forward integration, through the three approaches to 0.10, 0.14 and 0.36 a.u. In perihelion oppositions these perturbations can be observed at geocentric distances of roughly 0.6 a.u. The planet has been observed in 5 oppositions 1924–57, mostly near perihelion. Observers with powerful instruments are urged especially to observe this relatively faint object as extensively as possible, because undoubtedly the mass of Mars can be determined from the motion of (1011) Laodamia to a very considerable degree of accuracy.

REFERENCE

Rabe, E. 1956, *Minor Planet Circ.* **1474**.

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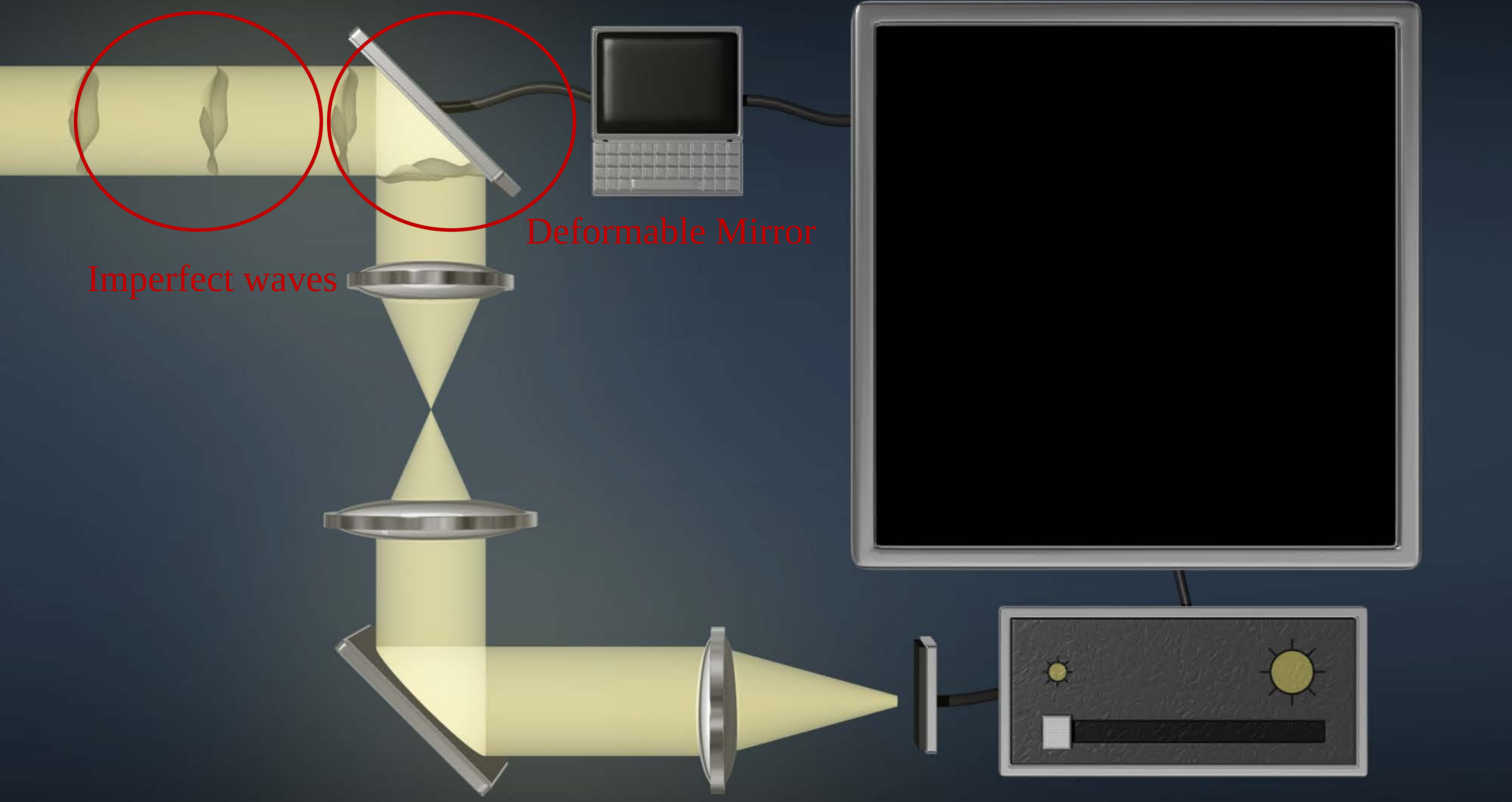
Cincinnati, Ohio

Roman, Nancy Grace. *Planets of other suns.*

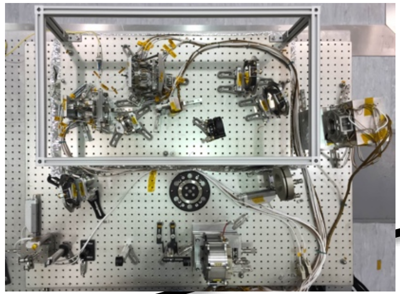
As seen from the distance of Alpha Centauri, Jupiter, at its maximum apparent separation from the sun, $3''.94$, would be a star of $23^{m}.4$ (assuming that its phase function is that of Venus); it would brighten to a maximum of $22^{m}.0$ at exterior conjunction. For Venus, Earth, Saturn, the maximum brightnesses and separations are, respectively: $22^{m}.5$ and $0''.55$, $23^{m}.4$ and $0''.76$, and $22^{m}.7$ and $7''.23$ (with the rings at moderate inclination).

Thus, a similar planetary system around Alpha Centauri would be within the reach of our largest telescopes and our current photoelectric techniques if our terrestrial atmosphere did not limit our resolution. At a separation of more than 2″, it does not seem to be a serious problem to get rid of the light of the primary in the absence of an atmosphere.


Imperfect waves
Deformable Mirror

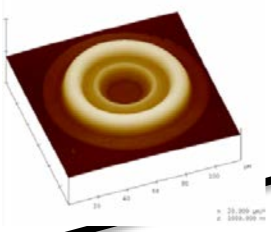
CGI Technology Demonstrations

Autonomous Ultra-Precise Wavefront Sensing & Control



First Use of Deformable Mirrors in Space

High Contrast Coronagraph Masks



Ultra-low Noise Photon Counting Visible Detectors

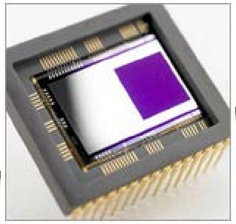


Image Processing at Unprecedented Contrast Levels