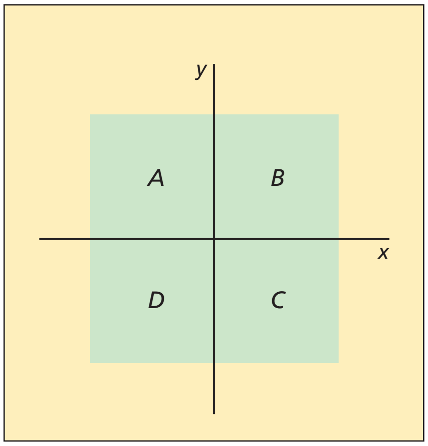
Photodetectors on Coronagraph Mask for Pointing Control

Light from a star under observation would be utilized instead of merely absorbed or suppressed.

NASA's Jet Propulsion Laboratory, Pasadena, California

It has been proposed to install a symmetrical array of photodetectors about the center of the mask of a coronagraph of the type used to search for planets orbiting remote stars. The purpose of this installation is to utilize the light from a star under observation as a guide in pointing the telescope. Simple arithmetic processing of the outputs of the photodetectors would provide indications of the lateral position of the center of the mask relative to the center of the image of the star. These indications could serve as pointing-control feedback signals for adjusting the telescope aim to center the image of the star on the mask.



A **Square or Rectangular Array** of four photodetectors would provide indications of the *x* and *y* displacements of a star image from the origin, which would lie at the center of a coronagraph mask.

The widths of central mask areas available for placement of photodetectors differ among coronagraph designs, typically ranging upward from about 100 µm. Arrays of photodetectors can readily be placed within areas in this size range. The number of detectors in an array could be as small as 4 or as large as 64. The upper limit on the number of detectors would be determined according to the extent of the occulting pattern and the number of functionalities, in addition to pointing control, to be served by the array.

In the simplest case, differential position measurements along two orthogonal axes (x and y) could be effected by use of four photodetectors in a square or rectangular array similar to familiar quadrant detectors. Denoting the reading from each photodetector by the letter designation of the photodetector as shown in the figure, the x displacement between the star image and the center of the mask would be proportional to

$$[(A + D) - (B + C)]/(A + B + C + D),$$

while the y displacement would be proportional to

$$[(A + B) - (C + D)]/(A + B + C + D).$$

This work was done by Kunjithapatham Balasubramanian of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

NPO-42552

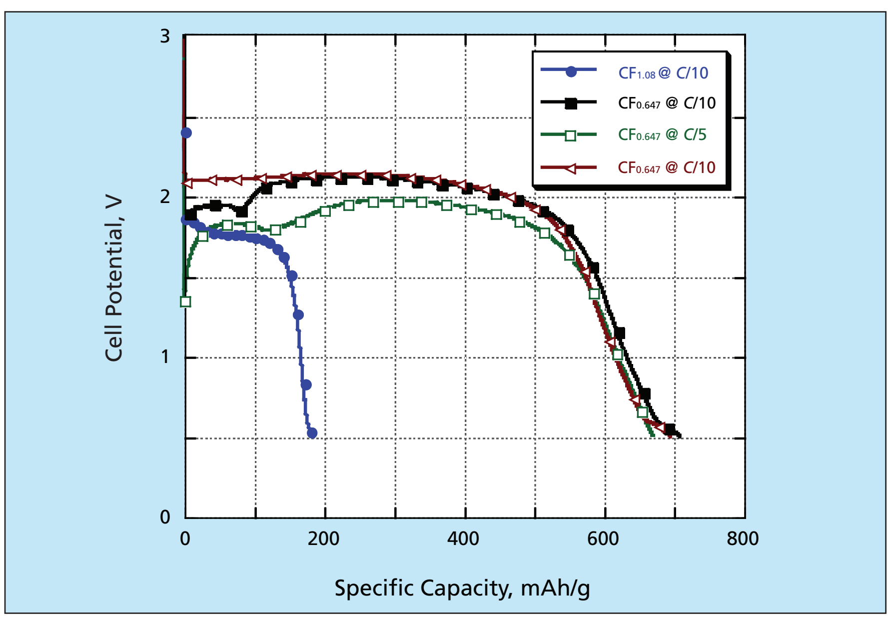
High-Energy-Density, Low-Temperature Li/CF$_x$ Primary Cells

Sub-fluorinated CF$_x$ shows promise as a generic low-temperature cathode material.

NASA's Jet Propulsion Laboratory, Pasadena, California

High-energy-density primary (nonrechargeable) electrochemical cells capable of relatively high discharge currents at temperatures as low as −40 °C have been developed through modification of the chemistry of commercial Li/CF$_x$ cells and batteries. The commercial Li/CF$_x$ units are not suitable for high-current and low-temperature applications because they are current limited and their maximum discharge rates decrease with decreasing temperature.

The term "Li/CF$_x$" refers to an anode made of lithium and a cathode made of a fluorinated carbonaceous material (typically graphite). In commercial cells, x typically ranges from 1.05 to 1.1. This cell composition makes it possible to attain specific energies up to 800 Wh/kg, but in order to prevent cell polarization and the consequent large loss of cell capacity, it is typically necessary to keep discharge currents below $C/50$ (where C is nu-



These **Discharge Curves** are typical of results of tests, at a temperature of −40 °C, of cells containing fully fluorinated ($CF_{1.08}$) and sub-fluorinated ($CF_{0.65}$) cathode materials. These tests were performed at a discharge rate of *C*/10 and *C*/5, as labeled. At a potential of 2 V, the $CF_{0.65}$ cathodes exhibited over 3 times the specific capacity of the $CF_{1.08}$ cathode.