This Letter describes a lithium arc lamp of new design that is easy to construct and use as a laboratory source for spectroscopic investigations. Although low-pressure discharge lamps are commercially available for a large number of atomic species, there is no commonly used lithium discharge lamp. Lithium lamps are difficult to construct because relatively high temperatures are required to achieve reasonable lithium vapor pressures, and because hot lithium vapor is highly corrosive and quickly attacks most window materials.

**References**


**Lithium heat-pipe arc lamp**

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![Cross section of the disk-shaped heat-pipe oven.](image-url)
We have circumvented these problems by containing a lithium vapor in the central region of a heat-pipe oven of disk-shaped geometry that allows large angular viewing of the discharge. The vapor is confined between two stainless steel plates as shown in Fig. 1 and is held in pressure equilibrium with a 1-Torr argon buffer gas that serves to isolate the hot lithium vapor from the cylindrical cell window. The plates are heated with propane-air torches to 750°C, at which temperature the lithium vapor pressure is equal to that of the buffer gas.

A discharge is established in the vapor by using the plates as electrodes and applying a voltage across them from a ballasted dc power supply. For currents in the $10^{-5}-10^{-4}$-A range, a glow discharge is established; for currents $>0.1$ A, an arc discharge is established. The discharge current changes discontinuously between these two ranges, giving rise to the break in the current-voltage relation of Fig. 2.

We have determined the maximum radiance of the arc to be 14 mW/cm$^2$ sr by forming an image of the brightest part of the arc on a small aperture in a screen and measuring the flux transmitted into a small solid angle. We have also estimated the total radiant flux from the arc to be 13 mW from the measured value of the flux hitting a silicon photodiode of known area placed a known distance from the lamp. The light emitted by the lamp is quite red in appearance because of the predominance of the 6104- and 6708-Å lines in its spectrum, as shown in Fig. 3.

This lamp design should prove useful in producing discharges in other corrosive or refractory materials. Since it is quite practical to clean the interior of the lamp and refill it with a different atomic species, a single lamp can be used to produce several atomic spectra.

To illustrate the use of this lamp as a light source for spectroscopic calibrations, we have used it to measure the previously known fine-structure splitting of the 6104-Å $3d \rightarrow 2p$ transition in lithium. This splitting of 0.13 Å or 0.34 cm$^{-1}$ is barely resolved in the presence of the 0.13-cm$^{-1}$ Doppler breadth (FWHM) of the transition. This fine-structure splitting is shown resolved in the Fabry-Perot interferogram of Fig. 4, taken with a finesse of 20 and a free-spectral range of 0.9 cm$^{-1}$.

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References

1. Another design for a lithium discharge lamp has been presented by B. Budick, R. Novick, and A. Lurio, Appl. Opt. 4, 229 (1965).