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## INK BLOTS AND PAPER JAMS

Ken Tapping, 5<sup>th</sup> September, 2017

Today, astronomical observations are highly automated. The sophistication and expense of the instruments means they are best left in the hands of appropriately trained personnel, and the routine operation is highly automated. Typically, the astronomer tells the system what data he or she wants, and the instrument makes the observations. For example here at DRAO, we make an observing template for the Synthesis Radio Telescope. The template indicates what we want to observe and how, and where we would like the data sent when the observations are complete. We receive the data and then analyze it. This separation of the science and the technology has resulted in scientists determining what sorts of data are needed, finding what instruments are available to provide it and then requesting observing time to be allocated to meet those needs. The researcher need not even be there.

Not that long ago things were different. Astronomers had to understand the instrumentation and often help set it up, and then of course to be on site to babysit the observations. This meant for example that a radio astronomer had also to be a bit of an engineer, and probably a computer programmer too. That is no longer the case, and with the sophistication of modern instruments, is becoming more or less impossible.

One unlamented device used in the past for recording radio telescope data is the paper chart recorder. The signal from the radio telescope is converted into a voltage which varies with the signal power. That voltage moves a needle, just as in an ordinary electrical meter. However, in this case there is a pen on the end of the needle, which is resting on a strip of paper varying from 10 cm to 30 cm wide. The pen draws a line on the paper, as a motor moves the paper. The result is a record made up of an ink line along the paper, showing how the signal strength has changed with time. For monitoring programmes, the chart recorders were left to record the data and the chart

retrieved later for analysis. If you were lucky! There was always a chance the paper would jam, the pen would get blocked or it would run out of ink. This resulted in lost data and an awful mess.

The ink for chart recorders was a special brew that was intended to be very permanent and made a good mark on the chart. It came in many colours, but a sort of glowing purple was the most common. It got everywhere. Cleaning and filling pens inevitably resulted in ink on fingers, yielding stains that did not easily wash off. If you did not notice the ink in time before touching your clothes....

Sometimes equipment maladjustment or a burst of strong radio interference would push the pen across the chart at high speed, causing ink to spray out. If you were standing in the wrong place, you could get a line of ink splatters across your shirt, which were difficult or impossible to remove. Paper jams were another hazard. However, when handled well those recorders were incredibly reliable. They were marvellous pieces of engineering, but we do not lament their passing.

Fortunately, our modern, more or less black box observing for most types of astronomical observations does not preclude our ability to do some observations that are more “off the main stream”. Our Synthesis Radio Telescope was not designed to observe the Sun or image the Moon, but some modifications to the hardware and some additional software made those things possible. There is still room for the “inventive scientist” who knows how to modify an instrument to get something different out of it.

Jupiter is now lost in the sunset glow. Saturn lies low in the southwest after sunset. Brilliant Venus rises in the early hours. Mars and Mercury lie low in the dawn glow. The Moon will be Full on the 5<sup>th</sup> and will reach Last Quarter on the 13<sup>th</sup>.

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