70th Anniversary of the Discovery of Radio Emissions from Neutral Hydrogen

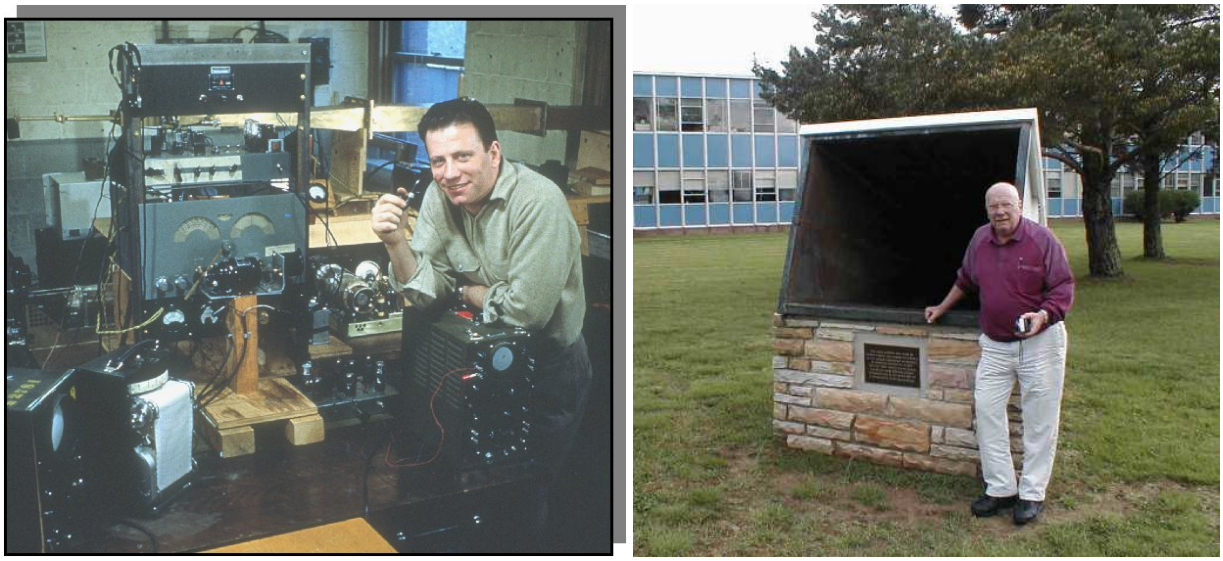
David K. Ewen (PAASEinst@gmail.com) sent SARA the following. David is the son of Harold “Doc” Ewen and he supplied the transcript of a conversation between Doc Ewen and Ed Purcell and the images below. See original article about the discovery in the 1 September 1951 issue of [Nature].

True space exploration began in 1951 at Harvard University. We are approaching the celebration of the 70th anniversary on March 25, 2021. On March 25th, 1951, the very first detection of hydrogen using a radio telescope with a horn antenna sticking out of a window on the 4th floor of the Lyman Physics laboratory at Harvard University was accomplished. This capability is the foundation of further discoveries allowing us to see the universe in a way never possible before. In 1951, on the 4th floor of the Lyman Laboratory, Harold "Doc" Ewen, Ph.D. was the first to observe and detect neutral hydrogen. His Harvard University thesis advisor was Edward, M. Purcell, Ph.D. This day made history in scientific space exploration.

Harold "Doc" Ewen, Ph.D. and Horn Antenna mounted on 4th floor window of Lyman Physics Laboratory at Harvard University Used to Detect Neutral Hydrogen on March 25, 1951

Since that time, radio astronomy has detected many new types of objects including pulsars and quasars. We can see a universe that radiates at wavelengths and frequencies we can’t see with our eyes. Objects in the universe give off unique patterns of radio emissions. Different wavelengths are generated by different objects and radio astronomers use a variety of methods and instruments to detect them. The radio signals detected by radio telescopes are converted into data that can be used to make images. For example, they are used to measure clouds of gas, which are abundant in the spiral arms of the Milky Way Galaxy making it possible to map the galaxy’s overall layout. Today, new radio telescopes provide ever more detailed views of the Milky Way.

In radio astronomy, radio waves that are in the electromagnetic spectrum, and radio astronomers use radio waves to see through all the large clouds of dust and darkness, to show even how gases swirl around Neptune and Uranus. When the hydrogen atoms crash, they make a bigger atom called a star, and a radio telescope helps us learn about them more by showing us those stars near us. Also, if you want to see some weird objects in the universe and even solve some mysteries, use radio telescopes.



Left: Harold "Doc" Ewen, Ph.D. in 1951 (note waveguide from the horn antenna at head level behind Ewen); Right: Harold "Doc" Ewen, Ph.D. and the Horn Antenna at Green Bank Observatory.

In 1987 Harold "Doc" Ewen and Edward M. Purcell, Ph.D. looked back to reminisce and spoke about the events that occurred on Easter weekend on the morning of March 25, 1951 that would forever change how we looked at our universe.

Doc Ewen – Originally, we didn't know whether the radio waves would actually be detectable. And the only thought at the time was if they were, they probably would be concentrated somewhere along the Milky way. And as a result, the best place to be looking would be toward the South in the vicinity, just north of Sagittarius, which is the center of the Milky way or our galaxy and just take a chance on the fact that there's a good concentration of material there.

Ed Purcell – Well, actually a good deal had been deduced from rather indirect evidence by the astrophysicist concerning the gas in our galaxy. And people know it was mostly hydrogen and that it was very empty. There were very few gas atoms per cubic centimeter. And in this empty thing, they're emitting this very thing, very characteristic radiation. The amount of hydrogen out there, and his temperature was such that the radiation at this frequency that we're concerned with is very special frequency amounted to only one watt landing on the entire earth

Doc Ewen – To attempt to detect a signal of that intensity less than a million millionth part of a lot, as far as what I was dealing with would be extremely difficult, even building an excellent radar receiver. I was concerned that we might be dealing downstream somewhere with a negative thesis and a negative thesis is extremely

difficult and could take an extra year or two to tidy up and calibrate and put some numbers on it. If you don't detect something, then you must carefully state at what level you're capable or incapable of detecting it. So that was my concern. Ed's comment [Edward M. Purcell, Ph.D.] to that was so it's a couple of years of your life and but it's certainly worth it. And if you do detect it, you'll be in LIFE magazine and he was right.

Ed Purcell – Well, as I remember, it was in the morning. So he'd been up all night and I'd been at home in bed. And as I remember, he said, I think I have a thesis. And I came dashing over.

Doc Ewen – It was over the weekend of Easter. And the first time I turned on the scanning of such as I was tuning, looking for this hydrogen hyperfine station, broadcasting from space, I was tuning through the spectrum. As you might just turn a knob. And I noticed at the end of the first scan, the signal was on its way up

Ed Purcell – And here on the Esterline paper from Esterline Angus Recorder, you know, it looked as wiggly line and looked as though there might be some bumps in and we rolled out about 20 feet of it and got down inside it along it, you see? And then we can see this bump like that.

Doc Ewen – It's just the way you designed it. It's just the way you thought about it. There was just a chill goes up your back and you say, I got it. And you'll just never, ever forget the excitement of doing something like that. And yet it's so common in the field of science to go through these steps and feel that excitement. It's just beautiful.

The 70th-anniversary celebration of the first detection of the hydrogen gas in the milky way at a 21 centimeter wavelength in 1951 by Harold “Doc” Ewen and Prof. Edward M. Purcell, his thesis advisor at Harvard University, will be hosted by the P.A.A.S.E Institute https://about.me/paase (a consortium of Professional Astronomers, Astrophysicists, and Space Explorers) in partnership with Harvard University, the National Radio Astronomy Observatory, and Green Bank Observatory.

Left to right: Ed Purcell, Taffy Bowen, Doc Ewen

[Nature] Ewen, H.I., Purcell, E.M. Observation of a Line in the Galactic Radio Spectrum: Radiation from Galactic Hydrogen at 1,420 Mc./sec.. *Nature* **168,** 356 (1951). https://doi.org/10.1038/168356a0: