To commemorate this International Year of Astronomy, three of NASA's flagship observatories have put a new spin on how we see the Pinwheel Galaxy!	*Panorama vid*
[Titles]	*Opening titles*
You might be hearing a little more astronomy buzz these days! That's because the International Astronomical Union and UNESCO have designated 2009 to be the International Year of Astronomy.	*[host CU]* *Night sky background*
What's the occasion? This year marks the 400th anniversary of looking at that… with one of these. In 1609 Galileo first turned a telescope towards the skies and began reporting things that would forever change the way we view the universe.	*[host]* *Night sky background, display Galileo's telescope*
To commemorate the anniversary of this new way of seeing the sky, NASA's Great Observatories have teamed up to give us a whole new way of seeing the famous Pinwheel Galaxy, or M101.	*Observatory beauty shots, final image of M101*
In 400 years, technology has advanced almost as much as our understanding. Today astronomers routinely scan the skies with spectacular telescopes, many of them seeing kinds of light that Galileo didn't even know existed!	*Pictures of telescopes with a spectrum running past*
In the 1970's this photograph of the Pinwheel galaxy, from Kitt Peak National Observatory in Arizona, was one of the best of the time. Larger telescopes and advanced digital detectors have continued to improve the view.	*Cross-fade between two KPNO views*

Space-based observatories have brought spectacular new ways of seeing the familiar objects like M101, as with these recent images from the Spitzer Space Telescope, the Chandra X-Ray Observatory, and the Hubble Space Telescope.	*3-Panel view of M101*
The combined image represents three different parts of the spectrum, spanning X-rays, visible, and infrared light. But how do we make a picture we <u>can</u> see using light we <u>can't</u> see?	*[host]* *Combined M101 in background*
The human eye is a remarkable biological instrument that detects electromagnetic radiation, or light. The eye's cone receptors come in three different varieties that let us independently perceive three different sections of the light spectrum: red, green, and blue. All the other colors we recognize in the visible spectrum are just combinations of these three.	*Image sequence:* *Human eye* *Three segments of colors that slide together to show a spectrum*
While the full spectrum of light extends far beyond what we can see, our Sun is brightest right in this range. That's not surprising. Millions of years of evolution should produce eyes that take maximum advantage of what the Sun provides! If humans were to evolve around a cooler star, their "visible" light would include what we call infrared!	*Sun & blackbody curves* *Additional cooler star and curve, visible spectrum slides to line up with that one.*
While they might even think of color the same way we do, their reds, greens, and blues would be entirely different than ours! So why not use technology to shift our colors around too?	*[host CU]*

Because of the way our eyes work, we can break down any color image into its red, green, and blue components. But what we display can come from anywhere in the spectrum we want!	*[host]* *video splits into component colors*
For instance, this Spitzer image of the Pinwheel galaxy draws the imagery entirely from the infrared spectrum, but presents them in our human-ready colors.	*Spectrum to one side, arrows showing which colors are pulled from which parts in Spitzer image*
We do the same thing with this Chandra image, but now we're using X-ray observations as the source. The colors we see now mean something entirely different than they did in the Spitzer image.	*Same graphic, but now for Chandra*
This is sometimes called a "false color image," but that makes it sound like something is fake. It's better to think of them as "representative colors," stand-ins for real colors that we can't see ourselves.	*[host]* *M101 image floats to side*
In contrast, we might say this Hubble view of M101 is "natural color" since it represents the colors more or less they way our eye sees them. That's assuming we could actually see something so faint and tiny.	*Same graphic, but now for Hubble*
This new image goes even further, combining each of the previous observations into a single view. Blue features are X-rays, red colors show the infrared, and visible light is yellow, which itself is a combination of green and red.	*[host]* *Image floats to side, host points and drags out each color component*
There isn't a formula that tells us exactly how to assign these colors. Art and aesthetics have a role to play along with the science.	*[host CU]*

We could make slightly different choices for representing the colors in these observations. This version emphasizes different features and has a visual impact. Some people like this one better, even though it's showing the same data.	*Alternate view of M33*
400 years ago, all Galileo had to explore the sky was a small telescope and a big curiosity. But today the heavens are just a few clicks away, with a richer color palette than Galileo could have ever dreamed.	*[host]*
For the Spitzer Science Center, I'm Dr. Robert Hurt reminding you that there's a Hidden Universe that, with a little digital help, everyone can see!	*[host CU]*