

Astronomers put together a universal wish list

Where we'll go, what we'll see till 2022

By Dan Vergano
USA TODAY

So what are you doing this decade? Astronomers have decided that they plan to discover alternate Earths and figure out the origins of the first stars, galaxies and black holes.

U.S. astronomers every decade prioritize their goals and the gadgets, spacecraft and telescopes needed to reach them. In the newly released National Research Council report, *New Worlds, New Horizons in Astronomy and Astrophysics*, headed by Stanford's Roger Blandford, astronomers plot the astrophysics agenda from 2012 to 2022.

"It is a consensus achieved through commitment," involving hundreds of astronomers, says Ralph Cicerone, head of the National Academy of Sciences, which oversaw the report's preparation. Some research topics emerge as winners — exploded stars, called supernovas, and alien planets — while others are pushed to the next decade.

"It is really very hard work," Cicerone says. The report is the sixth such "decadal survey" for astronomy, weighing astronomers' calls for new telescopes against the reality of federal agency budgets. Past surveys have reliably guided NASA and National Science Foundation spending in astronomy.



NASA/ESA

New galaxies: Astronomers will be looking for clues within galaxies from the earliest era of stars, such as this majestic face-on spiral galaxy deep in the Coma Cluster, captured by the Hubble Space Telescope.

In the past decade, astronomers have found more than 400 planets orbiting nearby stars, learned that super-massive black holes lurk at the center of most galaxies and determined the age of the universe, about 13.7 billion years.

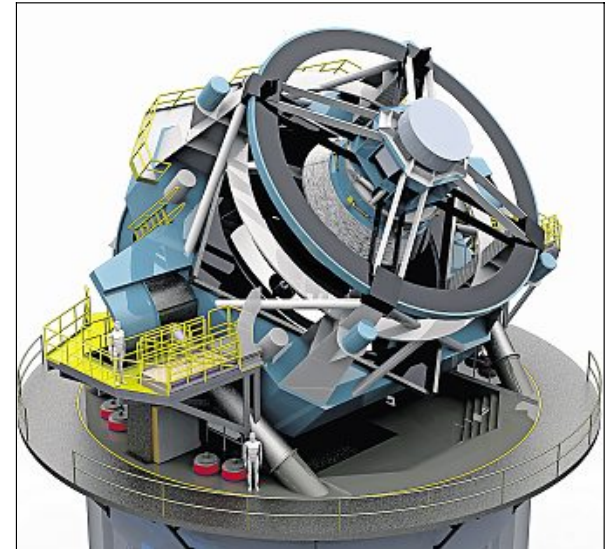
The report sets as a primary goal learning how the first stars formed, finding the "closest habitable Earth-like planets beyond the solar system," and probing

"dark energy," the mysterious force accelerating expansion of galaxies apart from one another throughout the cosmos.

"So much is going on in astronomy, it's a golden age," says astronomer Catherine Pilachowski of Indiana University in Bloomington. "I think they did a terrific job. Far more than in past reports, they have thought about budgets and how we are actually going to build these projects."

Top survey priorities include:

► The Wide-Field Infrared Survey Telescope (WFIRST) — a \$1.6 billion space telescope to be launched in 2020 that will eyeball exploding stars and gravity-distorted views of galaxies for clues to dark energy, as well as detecting habitable worlds orbiting stars in the center of our Milky Way galaxy. The spacecraft would fly a 10-foot-wide telescope mirror in an orbital path



Artist rendering by LSST Corp./NOAO

New gear: A proposed 8.4-meter Chile-based telescope will survey the entire visible sky deeply in multiple colors every week.

balanced between the gravitational pull of the Earth and sun.

► The Large Synoptic Survey Telescope (LSST) — a \$465 million telescope in Chile that by 2018 would investigate the report's priority areas, as well as "near-Earth" asteroids and dwarf planets beyond Neptune in our own solar system. The telescope would see the entire night sky once every three days.

► New Worlds — a \$4 million-per-year study to design telescopes that will be able to directly see habitable planets detected by missions such as WFIRST and the now-flying Kepler space telescope.

"We've been celebrating the good news all afternoon," says astronomer Kirk Borne of George

Mason University in Fairfax, Va., a member of the LSST team.

"We're putting the universe at your fingertips," he says, noting the telescope's observations, enough data to nightly fill 1 million DVDs, will be made available to the public through sky-watching applications hosted by Google and the Microsoft Corp.

The decadal survey constrained its picks for astronomical priorities under "conservative" budget guidelines provided by federal agencies, Blandford said at a briefing. But the researchers also produced a more "optimistic" budget should extra money arrive as part of the Obama administration goal to double the National Science Foundation budget.