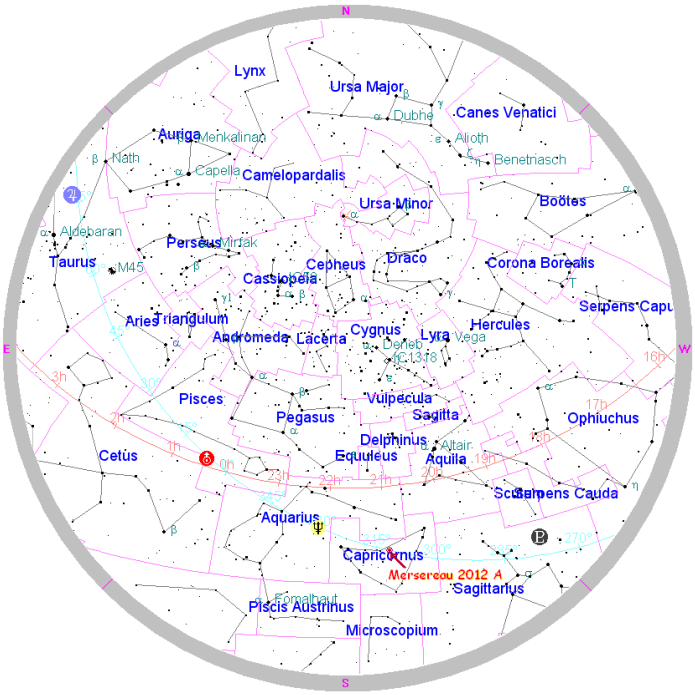
Ottawa Carleton Educational Space Simulation
News Release
October 10, 2012



An anomalous object, designated ***Mersereau-2012A***, has been detected in the constellation Capricorn by OCESS member Alex Mersereau. The brightness of the object and high rate of closure speed suggests that the object could be a "rogue" planet (a planet moving though space independently of any solar system).

A study of Mersereau-2012A has been chosen as the focus of the 2012/2013 OCESS mission. This could be our first opportunity to study a planetary body from another solar system and the interstellar material that it might have accumulated during its travels. If the object's path and velocity are such that the OCESS spacecraft can make an intercept, it may be possible to attempt a landing.

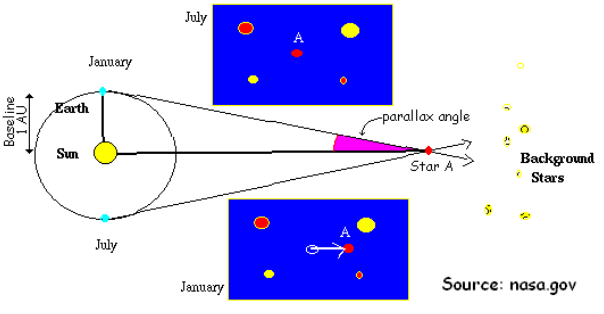
While it is possible at this stage that Mersereau-2012A might pass close to or collide with the Earth, the likelihood of this is very small. However the Jupiter system of moons and the asteroid belt also are possible targets for a close pass. These could offer an opportunity to study the effect of a moving gravitational field on a moon or asteroid. Perhaps a perturbation of the orbit of one of these solar system objects, similar to that which ejected Mersereau-2012A from its original solar system, could be observed. The next month will be spent gathering and analyzing data to plan a mission to closely observe and perhaps land on Mersereau-2012A as it passes through the inner part of our solar system.

<u>Current Location</u>

Mersereau-2012A is approaching the solar system from the direction of the constellation Capricorn. The current location - direction and ***distance*** - of Mersereau-2012A cannot be precisely fixed from data collected on earth or earth orbit. However, the following are pertinent to a rough estimation of distance as will be carried out by the OCESS astrometric analysis team:

1) a) The object's closure speed is quite high (see below)
   b) The object's reflected apparent brightness has not changed significantly over the past 10 days.
   The brightness of reflected solar light that we see from a distant object is proportional to $1/\text{distance}^4$.
   Therefore, the ***rate*** at which brightness increases itself changes as the object nears the earth.
2) The object's apparent brightness is high compared to Kuiper belt objects.
   Reflected brightness is a function of three variables:
   a) radius of the object
   b) albedo of the object; the percentage of incoming light that gets reflected back
   c) the distance to the object
   If reasonable estimates of the first two can be made, then an estimate of the third can be calculated.

A better estimate of the current distance to the object can be obtained by ***long baseline parallax*** measurements (the apparent difference in an object's position against the background stars when observed from two different locations).

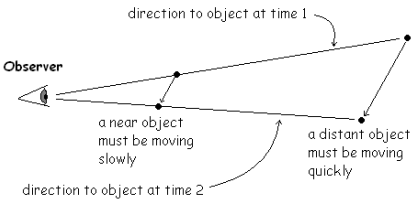


An Oct. 5th OCESS mission to the L2 Jupiter Lagrangian point (one of 5 gravitationally stable points around any planet at which a spacecraft can be parked) to deliver a satellite telescope to establish a baseline for simultaneous parallax observations had to be scrubbed after difficulties were encountered on docking with the orbiting main drive unit. This mission will be attempted again on Oct. 12th. Simultaneous observations are needed as the location of the object is changing rapidly due to its high closure speed.

Velocity

Reflected solar light from Mersereau-2012A exhibits a blue-shift, indicating that the object is moving towards earth at high speed. Analysis of the blue shift by the OCESS astrometrics team will determine the actual closure speed.

The object also exhibits a small, but significant tangential speed as evidenced by a parallax shift against the background star-field (an apparent angular velocity relative to the background stars). Further analysis must be conducted to determine what component of this shift is due to earth's motion around the sun and how much is due to the motion of Mercereau-2012A relative to the sun. In addition, the actual tangential velocity relative to the sun cannot be computed from the apparent angular without knowing the distance to the object. A given angular velocity could be cause by a slow rate of motion if the object is at close to the observer or a very high rate of motion if the object is more distant.



Until the actual tangential component of Mersereau-2012A is known, it will not be possible to predict its path through the solar system and plot a mission to intercept it.

Short-term Goals for Data Gathering and Analysis (days)

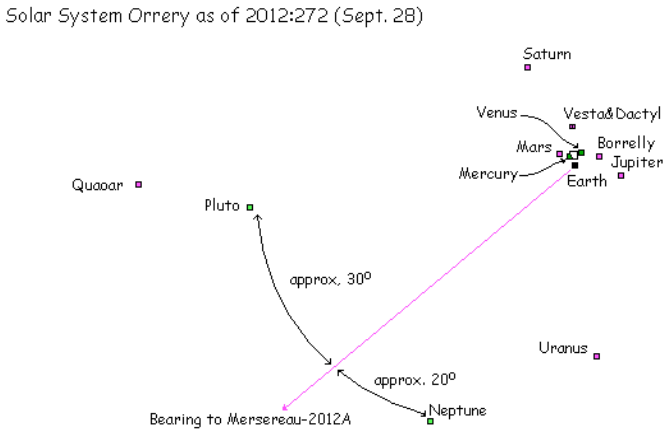
1) Calculation of closure (centripetal) speed from blue-shift data.
2) Determine distance to M2012A a) first by estimation
   b) later by parallax observations
3) Calculation of M2012A tangential speed from angular motion, distance, and Earth's motion around Sun.
4) Estimate the size of M2012A from distance and estimated albedo.

Medium-term Goals (weeks)

1) Calculate the path through the solar system and determine the feasability of an intercept and landing.
2) Evaluate the potential for undertaking a robotic reconnaissance mission (fast close pass or intercept and orbit which requires much more on-mission fuel).

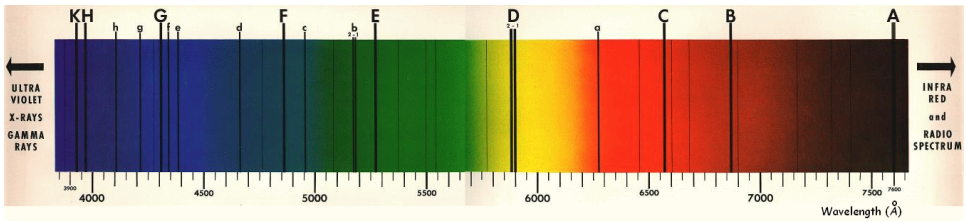
Long-term Goals (months)

Plan and conduct a mission to deliver an exploration crew to Mersereau-2012A and, if possible, safely land them on it.

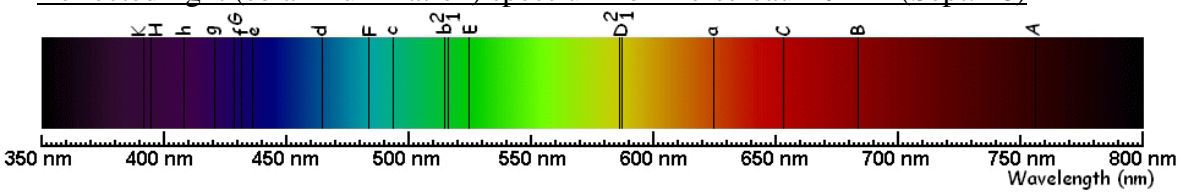


Data

Zero-velocity solar absorption spectrum



Reflected light (solar illumination) spectrum for Mersereau-2012A (Sept. 28)



Brightness (Reflected Solar Light)

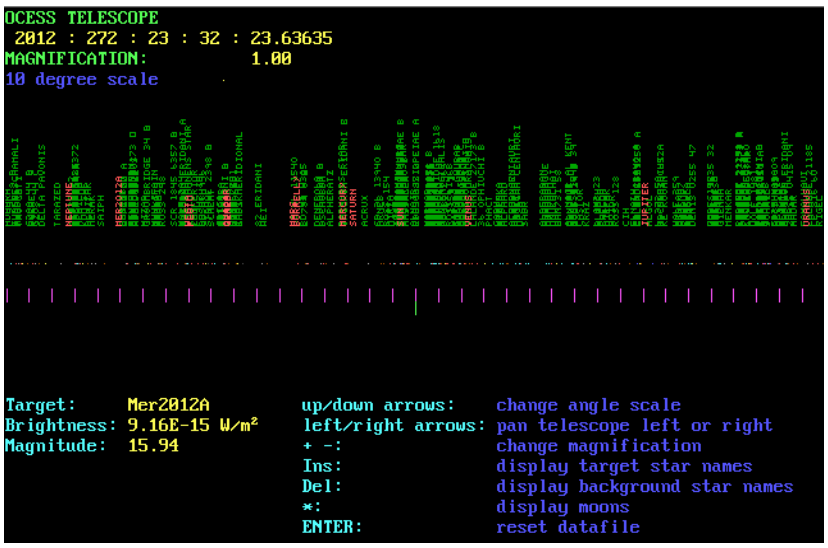
Sept. 28: Apparent Magnitude 16.30

Oct. 5: Apparent Magnitude 16.09

Absorption Line	Element	Stationary Source wavelength (nm)	Mer-2012A wavelength (nm)
A	O_2	759.4	756.58
B	O_2	686.7	684.15
C	H	656.3	653.86
a	O_2	627.6	625.27
D1	Na	589.6	587.41
D2	Na	589.0	586.81
E	Fe	527.0	525.04
b1	Mg	518.4	516.47
b2	Mg	517.3	515.38
c	Fe	495.8	493.96
F	H	486.1	484.29
d	Fe	466.8	465.06
e	Fe	438.4	436.77
f	H	434.0	432.39
G	Fe, C	430.8	429.20
g	Ca	422.7	421.13
h	H	410.2	408.67
H	Ca	396.8	395.32
K	Ca	393.4	391.94

M-2012A blue shift data for Sept. 28

Angular motion from Sept. 28, 2012 to Oct. 5, 2010



Mersereau-2012A relative to star 93415 (OCESS deep-field star catalogue)

Sept. 28, 2012: 80.5 arc seconds L

Oct. 5, 2012: 274.2 arc seconds L

Quaoar (a distant Kuiper-belt object) relative to star 1242

Sept. 28, 2012: 61.5 arc seconds L

Oct. 5, 2012: 24.6 arc seconds R

Parallax software and weekly telescope observation data download are available on the www.spacesim.org.

Reference Websites

http://www.harmsy.freeuk.com/fraunhofer.html

http://en.wikipedia.org/wiki/Stellar_parallax

http://csep10.phys.utk.edu/astr162/lect/stars/magnitudes.html

http://en.wikipedia.org/wiki/Magnitude_(astronomy) (note, solar visual brightness at earth is 1366 W/m^2)

http://en.wikipedia.org/wiki/Albedo

http://en.wikipedia.org/wiki/Effective_temperature (good equation for light power absorbed by a planet that could be modified to calculate reflected power)

http://www.school-for-champions.com/science/light_doppler_equations.htm

http://en.wikipedia.org/wiki/Blueshift