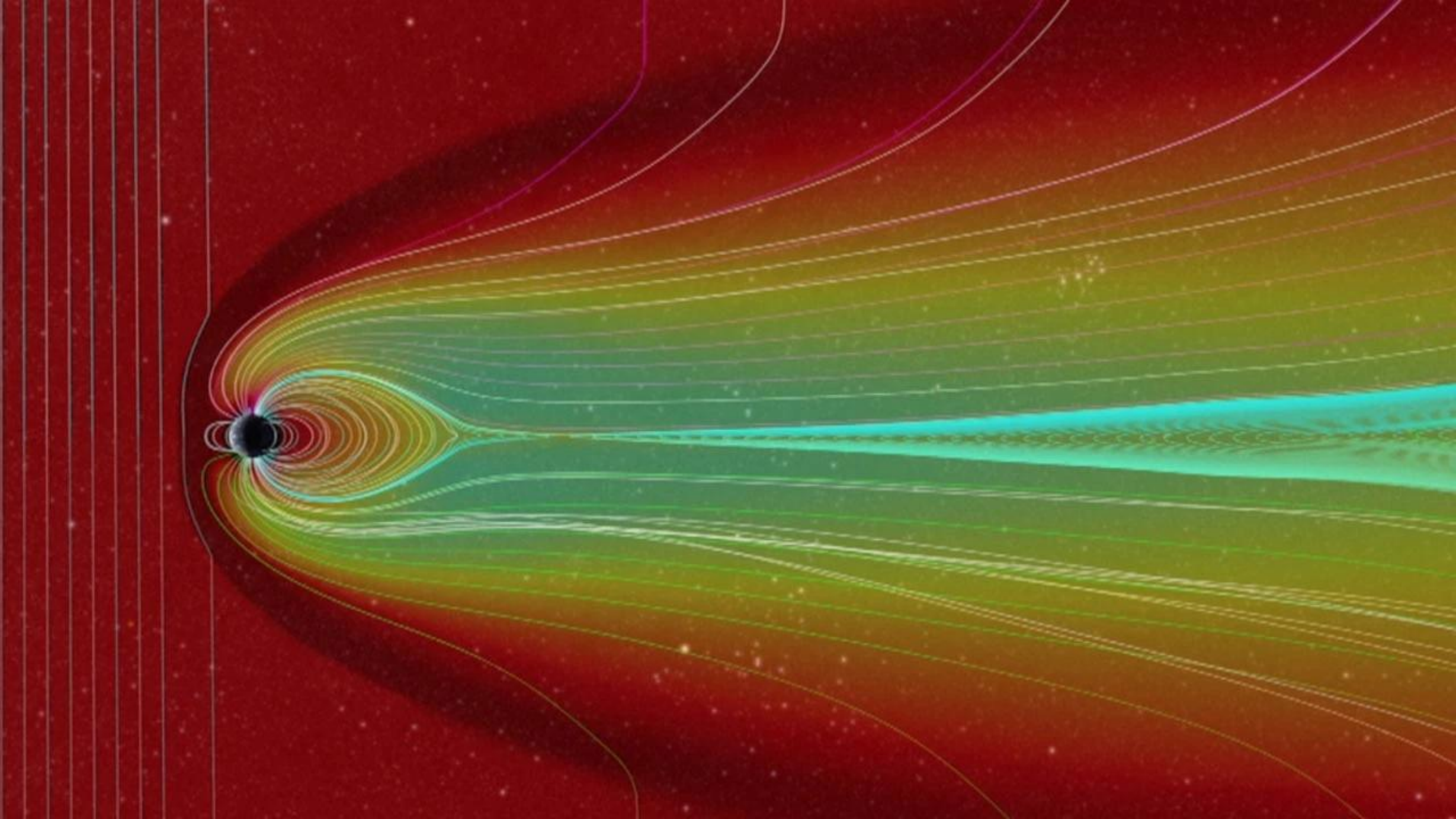

1
00:00:00,040 --> 00:00:04,090
tone

2
00:00:04,090 --> 00:00:08,090
music

3
00:00:08,090 --> 00:00:12,110
In this visualization, Earth's magnetic field structure is represented by lines. It

4
00:00:12,110 --> 00:00:16,130
corresponds to the paths that charged particles would travel close to the Earth.

5
00:00:16,130 --> 00:00:20,130
The sun's magnetic field, carried in the plasma of the solar wind,

6
00:00:20,130 --> 00:00:24,140
flows continuously by the Earth, distorting the planet's field,

7
00:00:24,140 --> 00:00:28,160
and pulling it back into a windsock-type structure.

8
00:00:28,160 --> 00:00:32,160
The red illustrates the higher density plasma that forms the magnetopause,

9
00:00:32,160 --> 00:00:36,180
the boundary between the magnetic influence of the sun and the Earth.

10
00:00:36,180 --> 00:00:40,230
The wind also forms a lower density magnetotail behind the Earth,

11
00:00:40,230 --> 00:00:44,230
represented by blue in this computer model. This process

12
00:00:44,230 --> 00:00:48,240
is happening all the time, as the solar wind is constantly flowing by

13
00:00:48,240 --> 00:00:52,280

the Earth. But a coronal mass ejection or CME can change

14
00:00:52,280 --> 00:00:56,290
things. The higher density plasma and stronger

15
00:00:56,290 --> 00:01:00,310
magnetic field, carried within the CME, strikes Earth's field

16
00:01:00,310 --> 00:01:04,400
and significantly alters the structure.

17
00:01:04,400 --> 00:01:08,410
The dramatic changes in Earth's magnetic field and the shape of the magnetopause

18
00:01:08,410 --> 00:01:12,470
as the CME passes Earth.

19
00:01:12,470 --> 00:01:16,640
Close to Earth, the magnetic field is largely unchanged. Earth is protected from the intense

20
00:01:16,640 --> 00:01:20,820
solar event. This for a rather ordinary

21
00:01:20,820 --> 00:01:24,840
CME. In this example, a CME launched by an X3 flare

22
00:01:24,840 --> 00:01:28,850
from December 2006. But what would happen in the case of a more

23
00:01:28,850 --> 00:01:32,880
intense event, such as the Carrington event of 1859.

24
00:01:32,880 --> 00:01:36,900
With the aid of similar computer models as before, we can explore some of the

25
00:01:36,900 --> 00:01:40,900
possibilities. Here, a much stronger CME

26
00:01:40,900 --> 00:01:44,910
compresses the magnetic field between the sun and Earth and generates more density

27
00:01:44,910 --> 00:01:48,920
in the bow shock, represented by darker red.

28
00:01:48,920 --> 00:01:53,100
The front of the magnetopause was pushed much closer to the Earth than usual.

29
00:01:53,100 --> 00:01:57,100
Even the field and plasma trailing behind the Earth are

30
00:01:57,100 --> 00:02:01,100
more strongly distorted.