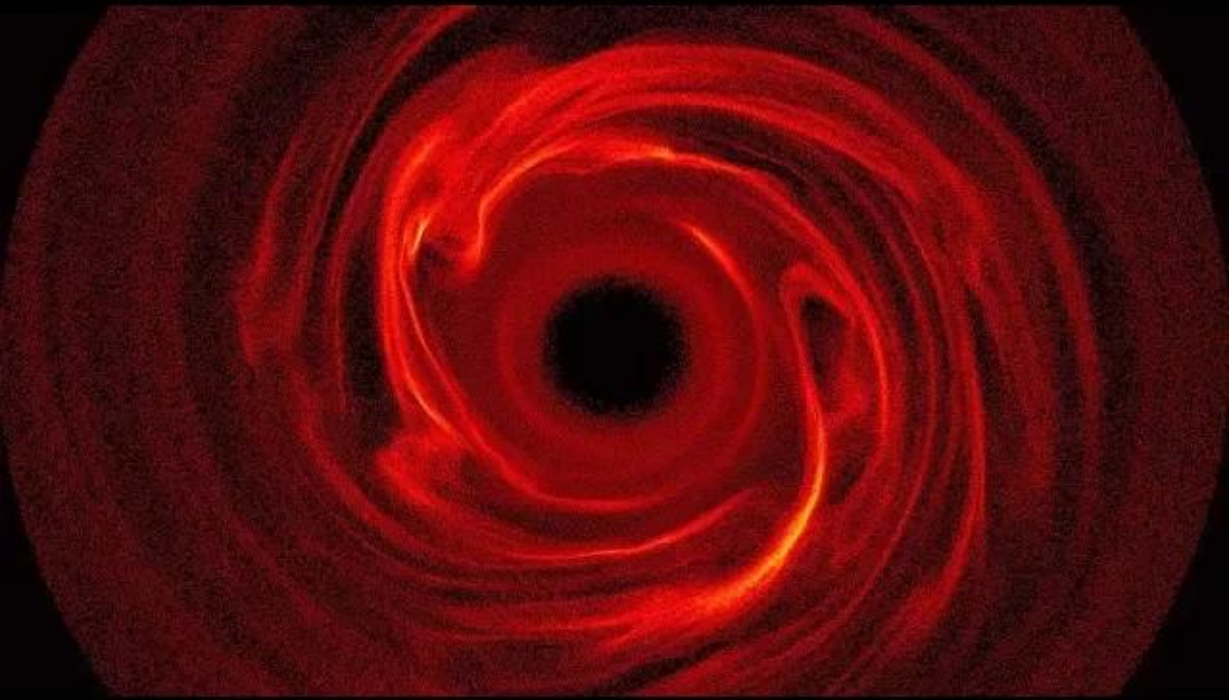

1
00:00:00,010 --> 00:00:04,050
■Music■

2
00:00:04,050 --> 00:00:08,090
Disks of debris around stars often show striking patterns...

3
00:00:08,090 --> 00:00:12,140
Like arcs

4
00:00:12,140 --> 00:00:16,170
■rings

5
00:00:16,170 --> 00:00:20,200
■and spirals.

6
00:00:20,200 --> 00:00:23,270
■Music■

7
00:00:23,270 --> 00:00:27,350
■Do these features tell us unseen planets are stirring gas and dust in these disks?

8
00:00:27,350 --> 00:00:31,480
■Music■

9
00:00:31,480 --> 00:00:35,610
■No, according to a new NASA simulation.

10
00:00:35,610 --> 00:00:38,780
■Music■

11
00:00:38,780 --> 00:00:42,980
■Interactions between dust, gas and starlight let disks form these patterns on their own.

12
00:00:42,980 --> 00:00:47,100
■Music■

13
00:00:47,100 --> 00:00:51,220

Starlight strips electrons from dust.

14
00:00:51,220 --> 00:00:55,270
■These electrons heat up nearby gas.

15
00:01:02,450 --> 00:00:59,310
■Music■

16
00:01:02,450 --> 00:01:05,600
■The gas pressure rises, trapping more dust

17
00:01:05,600 --> 00:01:08,790
■which then heats more gas, trapping more dust..

18
00:01:08,790 --> 00:01:11,990
■and a cycle of growth begins.

19
00:01:14,040 --> 00:01:18,090
■The interplay of dust and gas results in patterns like those seen in real disks.

20
00:01:21,150 --> 00:01:24,220
■Arcs, rings and spirals can form by themselves...

21
00:01:24,220 --> 00:01:26,280
■Music■

22
00:01:26,280 --> 00:01:29,310
■no planets needed.

23
00:01:38,650 --> 00:01:32,400
■Music■