UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

CALIFORNIA INSTITUTE OF TECHNOLOGY,
Patent Owner.

Patent No. 7,116,710

DECLARATION OF DR. HUI JIN

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I, Hui Jin, declare as follows:

1. I am a named inventor on U.S. Patent No. 7,116,710. I have personal knowledge of the facts set forth in this declaration.

2. I am currently a Co-Founder at JinYi Capital Management, where I am based out of New York, NY. Prior to that I was a Vice President at Goldman Sachs, also in New York. I worked at Flarion, which later became Qualcomm after an acquisition, in a Senior Technical Staff position. I received my Ph.D. in Electrical Engineering from Caltech in 2001, and my B.S. from Caltech in 1998, also in Electrical Engineering. My work has resulted in over 35 issued and pending patents.

3. During the 1999-2000 academic year, I was a graduate student at Caltech. Together with another graduate student, Aamod Khandekar, I worked under the supervision of Prof. Robert McEliece. Dr. McEliece's research was in the area of reliable storage and transmission of information. Aamod Khandekar (now Dr. Khandekar) and I specifically focused on research in the field of error correcting codes. Our goal was to create new, improved error correction codes that performed as close as possible to the Shannon limit while at the same time providing low-complexity encoding and decoding to allow practical implementation in real-world applications.

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4. Aamod and I met regularly with Dr. McEliece during the academic year to discuss our work. As part of our work we developed and tested numerous different coding structures, running simulations to assess their performance and determine whether they presented potential improvements to known error correcting codes.

5. In early 2000, Dr. McEliece, Aamod, and I had conceived of the Irregular Repeat Accumulate code that is described and claimed in the '710 patent. We then spent several weeks reducing our invention to practice, which was completed by early March. As part of our research for our invention, we found that the outer coder in a repeat-accumulate code could be generalized as a low-density generator matrix. We were then interested in studying the impact of combining an LDGM with an accumulator, but at that point we were not yet sure about their performance. We then experimented with different variations of the LDGM and discovered that specific irregular LDGMs could potentially lead to improved performance. I spent much of my time during this period figuring out irregular degree profiles that resulted in a significant improvement under different channel conditions and code rates. For all channel types we studied, we discovered through experimentation that carefully designed IRA codes came extremely close to channel capacity. For the Binary Erasure Channel, we were also able to prove

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that it achieved channel capacity. These were all significant developments at the time.

6. Our discovery of IRA codes is reflected in contemporaneous emails and notebooks from Dr. McEliece. On March 7, 2000 Dr. McEliece sent an email to Aamod and me, conveying a new realization of his that the generalized RA codes could alternatively be viewed as low density generator matrix codes followed by an accumulator. Ex. 2021. With this new understanding, Dr. McEliece stated that "what we want to consider is whether irregular LDGM outer codes gain us anything." *Id*. This confirms that we had already discussed the use of irregular LDGM outer codes, and were researching whether they could lead an improvement.

7. This development is also recorded in Dr. McEliece's lab notebook entry for that same day, March 7, 2000. Ex. 2022 at 21-22. In it, he noted that generalizing the RA code as an LDGM code followed by an accumulator "gets rid of the interleaver (sort of) and lets us focus on irregularity, etc." *Id*. This again confirms that we had already conceived of the irregular repeat-accumulate code as a new class of error correction code and were focused on researching whether they could improve performance. The Tanner graph in this entry also reflects other structural changes we discussed that made our IRA code different from the RA

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code: the summation of information bits before accumulation, as shown by the middle "check nodes" having more than one edge coming from the information nodes u_1 through u_3. This summation step was not in our original RA code. In addition, the Tanner graph shows that the check nodes have an irregular degree profile, which indicates we had already thought about using irregular LDGMs.

8. After we had conceived of the invention, Dr. McEliece, Aamod and I spent several weeks working out the implementation details of our Irregular Repeat Accumulate code. I devoted my time to figuring out which irregular degree profiles might improve performance in the AWGN channel, while Aamod worked on the Binary Erasure Channel. In early March, I had designed an irregular degree profile for an IRA code that I wished to simulate using practical block lengths, so I went to work writing code to implement and simulate the invention. By March 10, 2000, I had written code that created an Irregular Repeat Accumulate structure with a user-specified irregular degree profile. These code files were called IRA.h and IRA.cpp, and the first working versions were completed March 10, 2000. *See* Exs. 2023; 2024. For example, the file IRA.h was the "Head file for IRA." Ex. 2023, p. 1. As I explained in the notes of that file: "This file defines the class of Irregular Repeat Accumulate code. the code is essentially a concatenate of LDGM code and Accumulate code." *Id*. By March 13, 2000, I had an irregular degree

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