# The Super Audio Compact Disc (SACD)

CDs replaced the vinyl LP and analog cassette tape as the primary physical medium for music distribution, providing improvement in both sound quality and simplicity of use. After many years of service, the shortcomings of the CD became limiting factors: the obligatory 16-bit/44.1kHz quantization limits the dynamic range and frequency content to less than that which we are now capable of delivering. As a delivery medium the 16-bit quantization is generally still adequate. The continuous-playback design made computer access more difficult, though some may see that as an advantage as well. CD audio can easily be converted into files and computers with CD drives can also play audio CDs, though most computers no longer contain CD-ROM drives.

The DVD was designed for video playback and enjoyed wide acceptance for that use until it was replaced by the Blu-ray disc with even higher data capacity. These discs allowed higher sample rates and quantization depths for the accompanying audio but were not intended primarily for music delivery. A variant of the DVD expressly for audio (the DVD-audio) was designed and did appear for a short time but was not widely accepted, as very few titles were available compared to the CD library. While the DVD-audio disc was under development Sony created an improved replacement for the audio CD, the Super Audio Compact Disc or SACD. This medium is radically different from the CD-DA and DVD-audio that use PCM modulation. SACD uses Direct Stream Digital (DSD) encoding, a form of delta modulation, to write the bit stream directly to the medium. SACD is therefore incompatible with the other optical disc audio formats and cannot be copied like the PCM discs. It simplifies some of the A/D and D/A circuitry, resulting in an open-sounding audio playback many listeners favor as more similar to analog media. Since there is no multi-bit signal output from DSD, SACD players lack S/PDIF digital outputs. SACDs can produce 5.1 channel playback and have been used for surround mix releases of popular recordings, notable Pink Floyd's Dark Side of the Moon which may have sold nearly a million copies. The copy protection features of the newer disc technologies contribute to the desire of the manufacturers for their success. The improved sound quality contributes to the same desire among audiophiles, however the limited number of titles and waning support from Sony makes the continued existence of the SACD questionable. Many SACD releases are of the hybrid variety, where a PCM layer playable by CD players coexists with the SACD layer on the same disc. This allows listeners without SACD players to play the disc in traditional CD players. While the sound is not as good on the CD layer, these releases often do benefit from better mastering demanded by the DSD technology.

Recording systems that employ DSD are available from Tascam, the DA-3000, which is stereo only. Although the SACD has been adopted by artists and producers who seek a higher-quality delivery medium, its small market share and the need for consumers to buy a dedicated SACD player make its long-term prospects uncertain. Production costs are greater for SACD releases than for CDs.

Direct stream digital is available for multi-channel recording as well as for product release. Sony created the Sonoma workstation while they were developing the SACD and later spun it off as Super Audio Center, the current manufacturer and distributor of the Sonoma workstation. DSD multichannel recording has been available on the Pyramix platform as well.

Stereo DSD recorders have been adopted as a studio master format in place of analog 2-track. They allow a digital medium to transfer the data, which is then reproduced as an analog output to the mastering equipment. Since many mastering engineers resample mixes delivered on CD-audio discs, this represents no more work and allows greater dynamic range and frequency response than does the CD and even many high-bit PCM files.